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The Carnegie Profits.

It has long been an open secret that Mr. Carnegie has been in the habit of giving his establishment a periodical "shake-up" for no apparent good reason, and dispensing with the services of men whom pretty much everybody else considered to be very useful to him. He has tried this on Frick, who, instead of "bowing to the inevitable," as so many others have done, proposes to fight, and the position he has held has placed in his hands much good war "matériel." The nature of this matériel is indicated by a bill in equity filed by Frick as the first move in a suit against Carnegie to either prevent him from ousting Frick or to pay him something like what his minority interests in the concern are worth. Incidentally the public is given an opportunity of knowing something of what the other industries of the country—machinery builders, etc.—have been compelled to pay to the owners of this "infant industry."

From the summary of this bill made by Frick's counsel we take the following points of special interest:

"In 1892 there were two limited partnerships:

"1. Called Carnegie Brothers & Co., Limited, with a capital of $5,000,000, who made steel rails and owned only the Edgar Thomson steel rail mill in Braddock Township, and 2. Called Carnegie, Phipps & Co., Limited, with a capital of $5,000,000, who made all kinds of steel plates, structural material, iron forgings; made the material for and built bridges, made armor plates and made material for the same.

"This latter firm owned the Upper and Lower Mills in Pittsburgh, the extensive Homestead Mills at Homestead, the Keystone Bridge Works in Pittsburgh, the armor plate mill near Homestead, the Hartman Steel Works in Beaver County, and other properties.

"Carnegie owned over 50 per cent. of each of the old firms, and he, with Frick, Phipps and others owning interests in each, formed in 1892 what constituted a new partnership, called the Carnegie Steel Company, Limited. In this Carnegie retained over 50 per cent., and now has 58½ per cent., while Frick has 6 per cent. Both old firms were merged into the new, which had a capital of $25,000,000 and operated all the old works.

"The business from 1892 to 1900 was enormously profitable, growing by leaps and jumps from year to year until in 1899 the firm actually made on low-priced contracts in net profits, after paying expenses of all kinds, $21,000,000. In November, 1899, Carnegie estimated the net profits for 1900 at $40,000,000, and Frick then estimated them at $42,500,000.

"Carnegie valued the entire property at over $250,000,000, and avowed his ability in ordinarily prosperous times to sell the property on the London market for £100,000,000, or $500,000,000.

"Frick now alleges, right at the hight of this enormously successful business, whereby, at least in part, he made for Carnegie these enormous profits and values, that Carnegie suddenly, and with malevolent intent toward him, on December 4, 1899, arbitrarily demanded of him his resignation as chairman, and this without any reason except to gratify Carnegie's malice.

"Frick, in the interest of harmony, gave his resignation, and subsequently on January 11, 1900, after Carnegie had thus deprived him of his office, he (Carnegie) demanded of Frick that he (Frick) should sell to the firm his interest in it at a figure which would amount to less than one-half of what this interest is fairly worth. Frick refused to sell at that price, but offered to sell and allow three men to value the interest sold. Carnegie refused this and left Frick, threatening him for not yielding to his demand."

As to the capital actually paid in to create this business whose value is stated by Carnegie to be about $500,000,000, some light is thrown by that part of the bill which tells of the formation of the present organization. On this point the summary says:

"The agreement of 1892 provided that capital to the extent of $20,000,000 should be paid in cash on or before June 30, 1892, but made no provision for the remaining capital—viz., $5,000,000. Said amount of increased capital was never paid into the association in cash, either on or before June 30, 1892, or later. Said increase was made in the manner following:

"On June 30, 1892, the firm of Carnegie, Phipps & Co., Limited, declared a dividend of 200 per cent. on their capital stock of $5,000,000. The amount of this dividend thus declared was $10,000,000. On said June 30, 1892, the firm of Carnegie Brothers & Co., Limited, also declared a dividend upon their then capital of $5,000,000 of 200 per cent., making the amount of the dividend thus declared $10,000,000. Checks were given by Carnegie, Phipps & Co., Limited, to their members, and by Carnegie Brothers & Co., Limited, to their members, for their several shares of said dividends, said members being the subscribers to the articles of association of the Carnegie Steel Company, Limited.

"These checks thus given to said members were indorsed over by them in payment of their several subscriptions to the Carnegie Steel Company, Limited. In fact, no cash was paid by either of said limited companies, neither by Carnegie Brothers & Co., Limited, nor by Carnegie, Phipps & Co., Limited. There was not cash in bank to the credit of either company to meet said checks thus by each drawn.

The actual capital stock of the present concern is, according to this, $25,000,000, of which only $20,000,000 was paid in, and this not in cash, but in the form of shares of stock in previously existing companies, together with checks representing the 200

per cent. dividend which was not paid, and which there was no money to pay.

On this capitalization of $25,000,000 thus formed, Frick estimated the profits for the present year at $42,500,000, and the accompanying figures show that the estimate is well based. Very many of the manufacturers of the country are very well satisfied to make 10 per cent. dividends upon capital invested, but suppose that this concern were to make 20 per cent., there would still be, over and above this 20 per cent., the vast sum of $37,500,000, or enough to constitute a very respectable percentage of the selling value of all the iron and steel used in the country.

Considering the general return from business ventures and the facts that in machinery lines, for instance, it is more often than otherwise difficult to make a fair and decent return on capital invested and pay the fair value of services rendered in management, no such rate of profits can be justified. They cannot possibly be obtained without some form of monopoly and special privilege, nor without doing a grave injustice to other industries and to consumers generally; an injustice which is not unlikely to react harmfully to all industries and to again set wagging the tongues whose owners seem to think that all manufacturers are monopolists and make inordinate profits, and that corporations and monopolies are equivalent terms.

The American Machinery Building at Vincennes not Delayed.

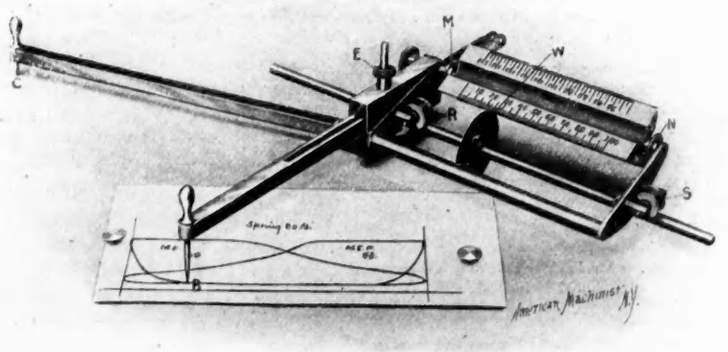
The report has been circulated that the American machinery building at Vincennes will not be ready to receive exhibits before the 1st of May. We are informed by Mr. Anthony, of the American Commission, that this report is not true; that the steel framework of the building was completely erected on the 9th of the present month, and that the building will be ready to receive exhibits on the 19th, being thus very much ahead instead of behind time. The Palace of Electricity is not well forward, and the installation of exhibits there will probably be somewhat delayed. But that is the fault of the Frenchmen, though Mr. Anthony thinks it may have given rise to the unfounded report regarding the American machinery building.

An Improved Horse-Power Planimeter.

In 1895 (page 544) we illustrated and described the Willis horse-power planimeter, showing in detail the principl upon which it operates, so that in speaking now of the lineal descendant, or the latest development, of that instrument it is not necessary to go into it so elaborately. From the fact that the indicator which we then showed gave the mean effective pressure direct, also the areas of regular or irregular figures in square inches, feet, or yards, without computation, it found ready appreciation and extensive adoption, and has constantly grown in favor.

The original polar planimeter has a recording wheel whose axis is parallel to the tracing bar, and this wheel slides sidewise on the paper for movements parallel to the tracing bar, and rolls along the paper for movements perpendicular o the bar. In the Willis instrument the wheel does not slide on the paper, but rolls for movements parallel to the bar, and slides upon its own axis for the perpendicular movements. The rolling movements of the wheel it is not necessary to record, all the readings being taken from the movement of the wheel in the direction of its axis. In the original instrument the recording wheel had a central sleeve which rolled upon a glass rod, and also slid along the same as the tracing movements required. In the present instrument the glass rod is replaced by a polished steel spindle, upon which the wheel is fastened and which glides beneath the two rollers seen in the half-tone, which gives the instrument great smoothness and accuracy of wheel movement, as well as rendering it thoroughly substantial and durable. The depressable pin avoids the trouble of turning the instrument over when setting to card length. The removal of the milled head screws permits the instrument to be taken to pieces and packed readily in a small leather covered case, 1½x3½x9½ inches, which can be carried in the pocket or in the case with an indicator. The white enamelled triangular scale has six graduated edges, and by turning the proper one next the wheel the mean effective pressure can be read directly from the card without calculation. The same scale can be used for setting for boiler pressures, vacuum lines, etc. The instrument is not only serviceable for measuring indicator cards, but, by reason of its various scales and adjustable arm length, will read areas directly in square inches, or directly in any units particularly suited to draftsmen and engineers, such as square feet, square yards on different scale drawings, acres on survey maps, etc. There can also be purchased with the instrument a horse-power attachment which permits the horse-power to be read directly from the indicator cards without calculation of any kind. This latter will be especially appreciated by engineers who have many cards to calculate or to report the horse-power regularly.

The instrument is now manufactured of brass and steel, fully nickeled, and presents a pleasing and attractive appearance. It is manufactured and sold by James L. Robertson & Sons, 204 Fulton street, New York, N. Y.



AN IMPROVED HORSE-POWER PLANIMETER.

The rusting of finished work shipped abroad is a matter that gives more or less trouble, and has stimulated invention along the line of preventatives. The newest thing for the purpose is "Steeloid," which can be readily applied, does not alter color, is not affected by heat or cold, will stand the brine test, and can be readily removed by benzine or kerosene.

One of our English friends, in speaking of an intended visit to this country, says that the "American Machinist" office seems to be an "international shop c ub." We are glad to have it so regarded, and it is a pleasure to us to greet here persons from any part of the world who are interested in machine shops and machine shop practice.

Several readers would like to know where they can obtain tauric acid, which we referred to in a recent issue. We have been unable to obtain it in New York, and would be glad to know where it can be obtained.

Commercial Review.

NEW YORK, FRIDAY EVENING,
February 16, 1900.

MACHINE TOOL MARKET.

Machine tools, commercially speaking, afford plenty of support for the optimist. There are some croakers of dullness, but the prominent selling firms that we have consulted report a good domestic business, and in certain cases the sales appear to have increased. There is abundant reason why active business should be tenacious of existence. During the past month, while machine tool builders have had so much work to do that they have had no time to reflect upon general conditions, their customers, particularly the big industrial corporations, have been piling up money by their own operations and have plenty to spend in buying more machinery.

Prices are characterized by a dogged determination to stay for a while on the level that they have already reached.

There is little danger that the market is about to become surfeited with stocks of tools. The condition which it seemed might be imminent when certain sellers got in heavy stocks last fall, of too many tools in the market, has not spread. It does not appear that sellers' stocks are now increasing very much. Deliveries, however, are generally quite easy on small tools. On heavy machines there is little relief.

"January was the most profitable month in orders booked we ever had," remarks a local dealer. "February bids fair to show as large a daily average. We have only one new planer in stock, although about forty are ordered. Stock orders are placed with the manufacturers, and then the tools are sold sooner than they can be delivered."

The effect of the South African war may be seen in a British inquiry which has arrived in this market for ten lathes, to be used for turning projectile shells.

A tool manufacturer who has concerned himself a good deal with the foreign market is of opinion that European buyers are coming to the point where they have all the American made tools they want, and that a tapering off of trade may hereafter be expected. We trust that it is not as bad as that.

Information from Worcester is to the effect that manufacturers of that place continue very busy, the names of Prentice Brothers Company and F. E. Reed Company being cited. The Woodward & Powell Planer Company is now moving into its new shops at South Worcester.

The office of the Higley Sawing and Drilling Machine Company and J. R. Vandyck, selling agent, was changed February 19 from 27 Thames street to 136 Liberty street, New York.

A corporation, the Società Anonima de Costruzioni Elettriche Brioschi Finzi & C., has been formed at Milan, Italy, to succeed the firm Brioschi Finzi & C., manufacturers of electric generators, transformers and motors.

NOTES FROM NEWARK, N. J.

Gould & Eberhardt now have some 370 men employed, twenty or twenty-five of them working at night. They are "as busy as ever." New work is still coming in freely and inquiry keeps up. Deliveries have grown a little easier from some cause or other, and trade, of course, is subject to fluctuations, but its general trend is substantially unchanged. The tools which the firm is selling most of are gear cutters and rack cutters.

The Watts-Campbell Company has entered quite a little boom in business after a relatively quiet period previous to the holidays, and indeed it is said that at no time in the past two years has trade been better than at present. Orders taken comprise many for high-pressure engines and some for direct-connected compound. Quite a number are being constructed for cotton mills in the North. Engine inquiries are now characterized by urgency in respect to delivery.

The Hewes & Phillips Iron Works are also receiving a run of orders for engines which is most encouraging as indicative of the present year's market. Contracts since the first of 1900 have been much more plentiful than during the second half of 1899. There is found to be an excellent demand from mills in this vicinity and in the Eastern States. The company is keeping its large tools at work nights. An engine of about 250 horse-power is just being shipped to the Paris Exposition, where, we understand, it will be used for driving pneumatic machinery.

The New Jersey Machine Works will have an excellent year for 1900 if business continues as it has been for the first month and a half. The company hopes hereafter to give an increasing amount of attention to the manufacture of gas engines.

W. G. & G. Greenfield, engine builders located in Harrison, adjacent to Newark, last week shipped an engine to the Isbell-Porter Company, and this week one to Wigan & Son for running burlap machines. They are getting out a new automatic engine. About the time of the Spanish war they built a good many engines for lighting, etc., on United States war vessels, eleven being furnished in 1898, three of them for the "Vulcan," and five in 1899. There was more activity at that time than at present, and it is remarked that the brass industry, for which they build foot and screw power presses, seems rather quiet; yet the shop is being run still with a pretty good complement of men.

The Torrance Manufacturing Company, of Harrison, maker of the Choquette waste saving device for woolen work and the Torrance patent balling machine for woolen and knit goods, evidence in their trade a situation in woolen manufacture which is stated the best in several years. They are now running their shop till 9 o'clock, and report an outlook for better trade in 1900 than in 1899. They have been fitting with the waste saver a number of mills at Philadelphia. Recent orders for the balling machines have come from various manufactories in the East, including the Tremont and Suffolk Mills, Lowell, Mass.

NOTES ON CINCINNATI TRADE.

There has been no previous period in the history of Cincinnati that gave such satisfactory evidence of progress and improvement in the machine tool, milling supplies and general manufacturing districts as that represented within the past year, particularly the last six months. A single evidence of this is furnished in the contract of the Lodge & Shipley Machine Tool Company, for instance, in taking the entire manufactured product of the Dietz Machine Tool Company, a new concern now but three weeks old. Vice-president and Secretary Murray Shipley, of the Lodge & Shipley Company, has just returned from a flying trip to St. Louis, Chicago and Pittsburgh, and announces the feeling general among company's agents in these cities as indicative of anticipations for the greatest year they have ever enjoyed.

Many other evidences of the healthy condition of the Cincinnati machine tool making concerns could be cited—the important improvements at the Linwood factories of the R. K. LeBlond Machine Tool Company's plant, the heavy foreign business of the J. A. Fay & Egan Company in woodworking lines, the several plants under way designed for the making of machine tools, two big real estate deals of the current week which will result in the establishment of large manufacturing plants of the machine making family, and finally, the important additions now under way to the machinery hall at the Norwood plant of the Bullock Electric Manufacturing Company, whose printing press teaser equipments are finding an enormous sale in England, Scotland, France, Germany and Russia.

The Industrial Bureau, an enterprise conceived and put into execution by three prominent officials and ex-officers of the Business Men's Club of Cincinnati, promises to be an important factor in the location and establishment of numerous manufacturing plants here the coming year. The idea is fathered and fostered by the club's ex-president, John H. Gibson, of the Gibson & Sorin Company, President Harry H. Suydam, of the Cincinnati Manufacturing Company, and B. M. Allison, a local insurance man. The machine tool making, woodworking and general supply men, members of the club, are taking a deep interest in the bureau's development. One feature of the work is to be the placing of Cincinnati in the estimation of the

world at large where she belongs as a center for the machine tool making industry. Confessedly the largest and most important in special lines in the world, Cincinnati, it is believed, has never fully received the appreciation she has deserved hitherto. This will be corrected, and the special salaried agents to be placed on the road and in communication with the heads of similar or allied industries in other parts of the country will be supplied with all necessary information to substantiate these claims.

The Lodge & Shipley Machine Tool Company has just turned out a very heavy new 36-inch lathe. The first shipments of the new type will go out the coming week.

The J. A. Fay & Egan Company has arranged with L. P. Pennypacker, of Guatemala, Central America, to represent that concern. He has arranged to represent other firms in his home city.

Two dividends were declared at a meeting of the directors of the J. A. Fay & Egan Company, February 12. One was the regular quarterly dividend, and the other an extra to make up one of the dividends passed during the depression several years ago. The same resolution provides the payment of similar dividends for the next quarter, which will make up for all payments missed during the hard times.

Local manufacturers of machine tools, in common with others, are deeply interested in the efforts under way to pass the new State license law for stationary engineers. A large delegation from Cincinnati appeared in Columbus during the week to protest against its passage. The feature of the new bill most objectionable to Cincinnatians is that it exempts from its rules and restrictions engineers of engines of less than 35 horse-power.

CHICAGO MACHINERY MARKET.

A large seller of machine tools notes the fact that the selling of special machines with him is just now considerably more active than that of standard tools. Most of his business is directly from shop to buyer; comparatively little from store. This call for the special machine is the same evolution that has been operative since the first tool was constructed, and may perhaps be interpreted to mean a further specialization of machinery. In seeking for an explanation, the upbuilding of large plants, where work is divided and subdivided, offers a plausible solution.

But the character of trade during the past few weeks seems to be more active with the smaller and widely scattered shops than with the larger manufacturer—that is, the trade in the standard lines of tools. There is in the aggregate a good generous business, but large transactions have not been specially prominent. Several representatives remark that the farther West is a better buyer of machinery than for a long time. Dawson & Goodwin this week shipped a carload of machinery to an old manufacturing plant at Pueblo, Colo. This is a typical example of the current business.

Woodworking machinery is moving quite freely. The American Woodworking Machinery Company reports a better business during the first half of February than it has experienced during the same period perhaps at any time heretofore. Other makers make similar statements. Planing mills are among the best buyers, and the outlook for building operations this coming season is regarded as most excellent throughout the West. This does not apply to the Chicago trade, the future of which has not yet emerged from the obscurity of labor differences.

In fact, the local situation is rather more dubious than it has been heretofore, owing to that cause. It would not be surprising if the near future were to develop a hegira of manufacturers from Chicago to the blander and less nerve-racking atmosphere of rural districts. Some of the piano makers, whose business has been paralyzed by the protracted lockout, are looking for new sites in the country, and some have already put plants of that kind into operation. It is reported that brass founders, machine shop owners and various other lines of manufacturers are indulging in the same trend of thought. Machinery men are discussing this phase of the local situation with considerable interest. Their conclusion is that there will be the same volume of business. The only difference is that it may go to the country at the expense of Chicago.

SPECIAL CHICAGO NOTES.

The industries whose center is Chicago, as well as the machinery dealers there, report an unabated state of activity. Several new works and enlargements have been recently completed or are now in progress. Of these may be mentioned the entirely new plant of the H. W. Caldwell & Son Company, whose specialties are conveying, elevating and power transmitting machinery. The new works are located at Western avenue, Seventeenth and Eighteenth streets. The Q & C Company has completed two additions to its works at Chicago Heights, one being 260x60 feet, and the other 60x80 feet. The additions have about doubled its capacity. Pressed steel work has been added to its line of goods. The Standard Pneumatic Tool Company has increased its capital stock and has bought the Hinkley Works at Aurora, Ill., the main building being 45x160 feet, two stories, with wing, foundry, etc., in addition, and is refitting it for its use.

The growth of the pneumatic tool business is one of the phenomena of the day. The Chicago Pneumatic Tool Company is but five years old, the original investment having been $150. Its sales to-day approach $100,000 a month, the business for 1899 having been fourfold that of 1898. The growth of the Standard Pneumatic Tool Company has been no less remarkable. It started in business but two years ago with a force of three men, and to-day it employs 180. The products of both these companies go to about every civilized country of the globe, foreign shipyards being especially large customers.

The Pearson Machine Company finds trade as good as ever. It exports its tools in large numbers, and is especially gratified at the recognition which it receives in New England. Rudolphi & Krummel are also as busy as the traditional bees.

The Steel Ball Company is so unable to cope with the business offered that it finds life almost a burden. Its present output is 600,000 a day, and this will soon be increased to a round million. The bicycle business appears to be recovering from its slump. It is understood that orders already booked aggregate 85 per cent. of last year's production. In addition to this, ball bearings are daily extending their field. The apparently insignificant furniture caster is expected to require over a hundred million balls the coming year. Such figures seem almost beyond belief, but they are given as sober truth.

Quotations.

NEW YORK, Monday, Feb. 19, 1900.

Iron—American Pig, tidewater delivery:—

Pennsylvania Irons:	
No. 1 X foundry	$23 70 @ $24 20
No. 2 X foundry	22 70 @ 23 20
No. 2 plain	21 70 @ 22 20
Alabama Irons:	
No. 1 foundry	22 25 @ 23 00
No. 2 foundry	21 25 @ 22 00
No. 3 foundry	20 25 @ 21 25
No. 1 soft	22 25 @ 23 00
No. 2 soft	21 25 @ 22 00
Foundry forge	19 75 @ 20 75

Bar Iron — Base sizes — Refined, mill price on dock, 2.25 @ 2.35c.; store price, 2.50 @ 2.60c.; common from store, 2.45 @ 2.50c.

Tool Steel—Base sizes—Standard quality, 7 @ 8c.; extra grades, 12 @ 14c.; special grades, 16c. and upward.

Machinery Steel—Base sizes—Ordinary brands from store, 2.80 @ 3c.

Cold Rolled Steel Shafting—Base sizes—From store, 4 @ 4.40c.

Copper—Lake Superior ingot, 16¼c.; electrolytic, 16 @ 16⅛c.; casting copper, 15¾ @ 16c.

Pig Lead—Wholesale lots, 4.70c., New York delivery; carloads, 4.72½ @ 4.75c.

Pig Tin—In 5 and 10-ton lots, f. o. b., New York, 32 @ 32½c.

Spelter—Prime Western, 4.65 @ 4.70c., New York delivery.

Antimony—Cookson's, 11 @ 11¼c.; Hallett's, 9¾c.

Lard Oil—Prime City, present make, 52 @ 54c. in jobbing lots.

Falling Speeds for Short Distances.

BY WILFRED LEWIS.

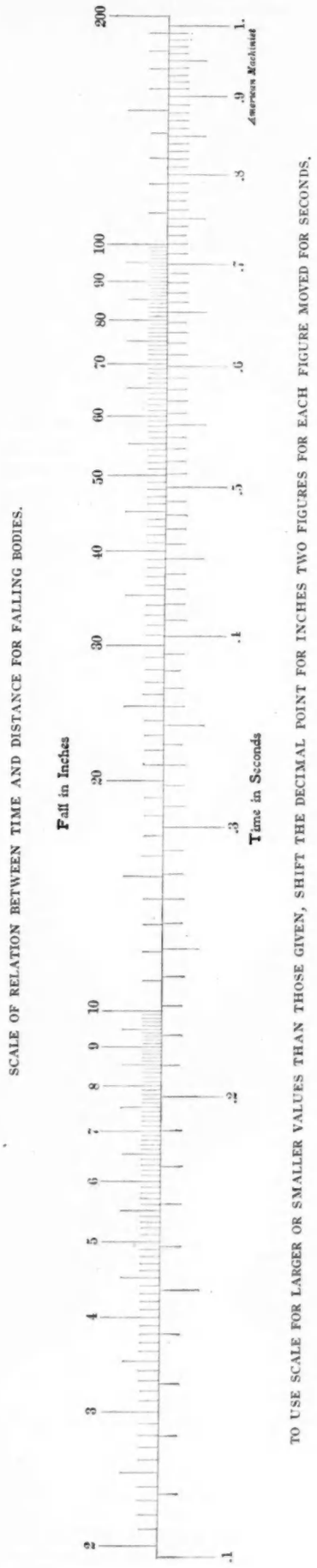
Referring to the article by Oberlin Smith in the "American Machinist" of December 28, I think that no one will question the wisdom of tabulating for convenient reference such relations as may repeatedly arise for determination, and, in regard to the constantly recurring relation between time and distance in falling bodies the table which he has given will be welcomed by all who have to deal with the problems he described. Such problems have recently demanded a large share of attention in the engineering department of Wm. Sellers & Co., Incorporated, and, when Mr. Smith's article appeared, I was asked to prepare a similar table particularly adapted to our needs. In thinking the matter over, I was tempted to construct a diagram on which, by means of a parabolic curve, the desired conversion could be made, but as such a diagram had limitations and defects not easly overcome, it occurred to me that here was a case for the application of logarithmic co-ordinates, not unlike that so well illustrated by Mr. Bruce in his diagrams for the strength and elasticity of steel springs. I saw, however, that nearly all possible conversions were obtainable on an ordinary slide rule, and that the slide rule failed only from lack of sufficient length. Instead of making a diagram, I therefore concluded to make a scale of the proper length, using my slide rule divisions as a guide in ruling. By this means the scales of time and distance have been brought into juxtaposition so that either may be read at once from the other without the intervention of a line of transfer like the parabolic curve originally contemplated. Other values than those figured are obtained simply by shifting the decimal point for inches twice as far as for seconds. Very minute fractions are therefore shown as clearly as whole numbers, and with the same degree of accuracy. The scale is therefore of general application to any class of work, and it is offered to your readers not only as a substitute for the table referred to, but also as a suggestion for the rapid solution of other similar problems.

[The instructions given with the diagram show that since it is impossible to add half a point to the figure for seconds, an even number of points must be added to the figures for inches. Thus, the figure for 5 may be used for 5, 500, or 50,000, but not for 50 or 5,000. On the other hand, the figure for 50 may be used for 50, or 5,000, but not for 500 or 50,000. We thus obtain from the figure for 5:

Fall in inches.	Time in seconds.
5	.161
500	1.61
50,000	16.1

and from the figure for 50

Fall in inches.	Time in seconds.
50	.508
5,000	5.08


SCALE OF RELATION BETWEEN TIME AND DISTANCE FOR FALLING BODIES.
Fall in Inches
Time in Seconds
TO USE SCALE FOR LARGER OR SMALLER VALUES THAN THOSE GIVEN, SHIFT THE DECIMAL POINT FOR INCHES TWO FIGURES FOR EACH FIGURE MOVED FOR SECONDS.
American Machinist

The same results may be, of course, obtained from the slide rule by setting 1 of C below 194 of A and then comparing time on C with inches of fall on A, but this setting gives a range of from .1 to .719 seconds only, and to cover the range of this diagram three settings are necessary, with the possibility of error that always pertains to combinations of the upper and lower scales.—Ed.]

New York State Labor Figures.

The annual report of the Commissioner of Labor of the State of New York has recently been made public. It begins with an enumeration of the industrial accidents during the year. It is to be noted that the figures given in the report are none of them exact.

About 700 workers met death in the State last year through accidents, not including the fatal accidents to employees of railways in the State, and probably not fewer than 40,000 suffered injuries, many of which were trivial, but 6,000 of which caused disablement for a period in excess of three months. A special investigation was made with the co-operation of the Factory Inspector during the months of April, May and June, 1899, covering 452,425 employees in industries of all kinds. The average number of injured in each 1,000 employed was 16.11. Attention is called to the fact that in the State of New York employers are liable to pay damages to employees only under judge-made law, no statute having been enacted by the Legislature. The report discusses what has been done for the protection of employees in other countries, notably in Germany, and calls attention to the fact that both employer and workman in the great European countries have joined in promoting legislation which gives to every workman injured while at his occupation the right to a stipulated compensation without recourse to law. The report says:

"The underlying principle of these workmen's compensation acts, as they are called, is the demonstrated fact that most accidents are an incident of the industry rather than the fault of individuals. Laws for the prevention of accidents have accomplished so little principally because a vast number of accidents is positively inevitable under the pressure of competition. When a workman, in order to save time, risks his fingers too near a circular saw, and eventually receives a bad cut, it is idle to reproach him with his own carelessness. He was saving time for his employer and taking the risk in his employer's service. The hazard of accident is to be treated in precisely the same manner as progressive business men have treated the danger of fire, *i. e.*, to be insured against and the cost of insurance charged against the expense account. It thus becomes a charge upon the industry and is eventually paid by the community as consumers. In some countries accident

insurance is compulsory, the purpose being the prevention of losses to injured workmen whose employers become insolvent. . . .

"The one obstacle to such needful legislation in each State will be the apprehension of driving out capital. This view, however, overlooks the expense already involved in the liability of employers under the present system, an expense that can be partially estimated now that insurance companies have entered upon the business of assuming the liabilities of employers according to a fixed schedule of rates. This business sprang up in England as a result of the employers' liability act of 1880. Several companies were incorporated, which made it a special part of their business to indemnify an employer not only against his liability to pay for injuries to his employees up to the statutory limit of the act, but also against all costs incurred by the employer for the defense of any action for damages for injuries brought by an employee. This means in practice that employers carrying liability insurance report every accident in their establishment to the insurance company, to which they refer for adjudication all claims of injured employees."

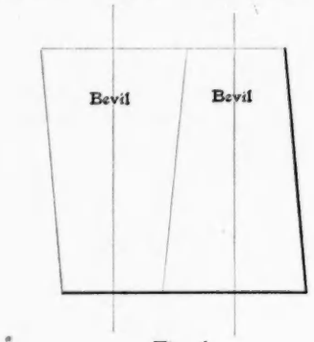


Fig. 1

TWO FELLOWS SPUR-BEVEL GEARS WITH PARALLEL AXES.

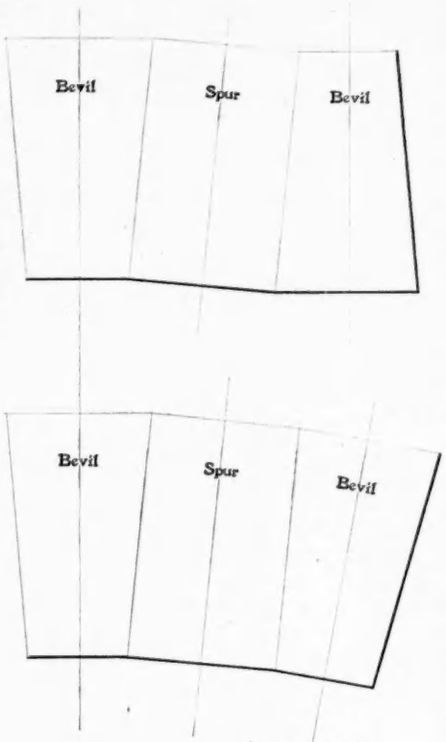


Fig. 2

TWO FELLOWS SPUR-BEVEL GEARS IN COMBINATION WITH A SPUR GEAR.

The second part of the report relates to employment and wages. The report says:

"In order to ascertain the state of employment and condition of trade since 1895, the bureau early in 1899 addressed blank schedules to several thousand manufacturers in the State. Reports were received from over 5,000 firms, and of these 4,931 reported the number of persons employed on June 30, 1899, and the amount paid in wages during the twelve months that ended on the same day. While the number of establishments reporting is very small compared with the number given in the United States Census (1890), they include most of the larger employers, and, therefore, comprehend a large proportion of all the working people engaged in manufacturing industries in New York State:

	Number of Establishments.	Number of Employees.	Annual Amount Paid in Wages.
Bureau of Labor statistics, 1899	4,931	452,425	$199,611,015
United States census, 1890..	65,840	850,084	466,846,642

"Making due allowance for the growth of business since 1890, it appears that the bureau's returns cover between one-third and one-half of the manufacturing industry of the State. The explanation, as already suggested, is the concentration of capital and labor in large establishments. An analysis of the bureau's returns shows that less than 10 per cent. of the establishments considered employed nearly 50 per cent. of the wage earners."

The third part of the report tells of the work of the State Free Employment Bureau; 5,289 persons registered for employment and the number of situations secured was 2,401.

The fourth part of the report is devoted to organized labor. On September 30, 1899, there were 1,320 labor organizations in the State, an increase over the previous quarter of 110. The largest numbers of unions are in the building trades.

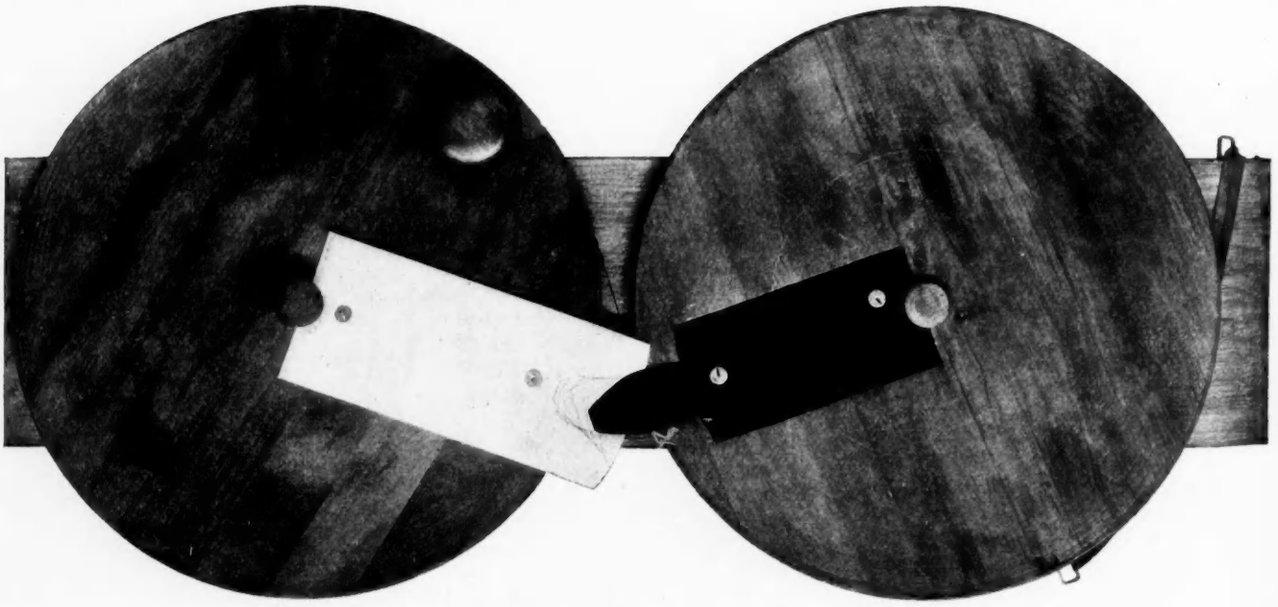


FIG. 3. DEVICE FOR SHOWING THE EFFECT OF VARYING CENTER DISTANCES UPON GENERATED TEETH.

The Fellows Spur-Bevel Gear.

We give this name to the curious gear which was shown in the article on "Some Things Seen at the Works of the Fellows Gear Shaper Company," published in our issue of February 15. It will be remembered that while the gear was a bevel in its outside and pitch circle diameters, it was a spur in its base circle diameter, and while the outside and pitch circles may be held to rule and to determine that the gear is a bevel, there is another reason for calling it a spur, and that is that it would mesh correctly with a spur. Were the cutter from which it was made to be extended in length until it was as long as the gear under discussion, it would obviously form a true spur and the two would mesh correctly together. It may be said that the inclination of the axes makes the gear a bevel, but this proves too much, as it would make the extended cutter also a bevel, which by all definitions it is not. Moreover, while this gear will mesh correctly with a spur, it will not so mesh with another bevel with the axes at an inclination as usual, but it will mesh with a reversed bevel, the axes being parallel, as in Fig. 1. Using an intermediate spur, the combinations shown in Fig. 2 may be made, in the upper one of which the outer axes are parallel, while in the lower one they are inclined.

While, therefore, from one point of view, the gear may be said to be neither spur nor bevel, from another it may be said to be both, and although the term spur-bevel gear may be said to belong to the same class as "round square," nevertheless if the gear is not a spur-bevel, what is it? We think it clear that the gear partakes sufficiently of the properties of both classes of gears to justify the name.

It is certainly of uncommon interest, and we have thought it worth while to go into its formation more deeply than was done in the former article. For this purpose the Fellows Company has at our suggestion kindly made the model shown in Fig. 3, consisting of two disks supported on a base-board by two pins, about which they are free to turn. The base-board has a set of three holes, in either one of which one of the pins may be inserted, and the center distance be thus varied; this center distance being normally 12 inches, but the two extra holes making it 11½ and 12¾ inches, respectively. A wire is wrapped on each disk, which represents the line of action of the teeth and communicates correct motion from one disk to the other, and a rubber band serves to keep the wire taut.

One of the disks carries a paper template which has been carefully laid out to represent an involute tooth outline, and the other carries a piece of paper, extending below the template, and on which successive positions of the template may be drawn to illustrate the method by which the Fellows machine generates its gears. These outlines have been drawn on the paper pinned to the model, and they will be clearly seen in the picture—the center distance in this instance being the normal distance, and the resulting tooth outline being the normal one.

The outline thus drawn illustrates the formation of the tooth curve at the center of the spur-bevel gear, and to show the formation at the ends it is only necessary to adjust the center distance, supply a new piece of paper and draw a new series of template outlines. This has been done, and the results, together with an additional set of curves at the normal distance, are shown in Fig. 4, of which the left-hand diagram shows the outlines at the reduced center distance or the small end of the spur-bevel gear, the center diagram the outlines at the normal center distance or the center of the spur-bevel, and the right-hand diagram the outlines at the increased center distance or the large end of the spur-bevel.

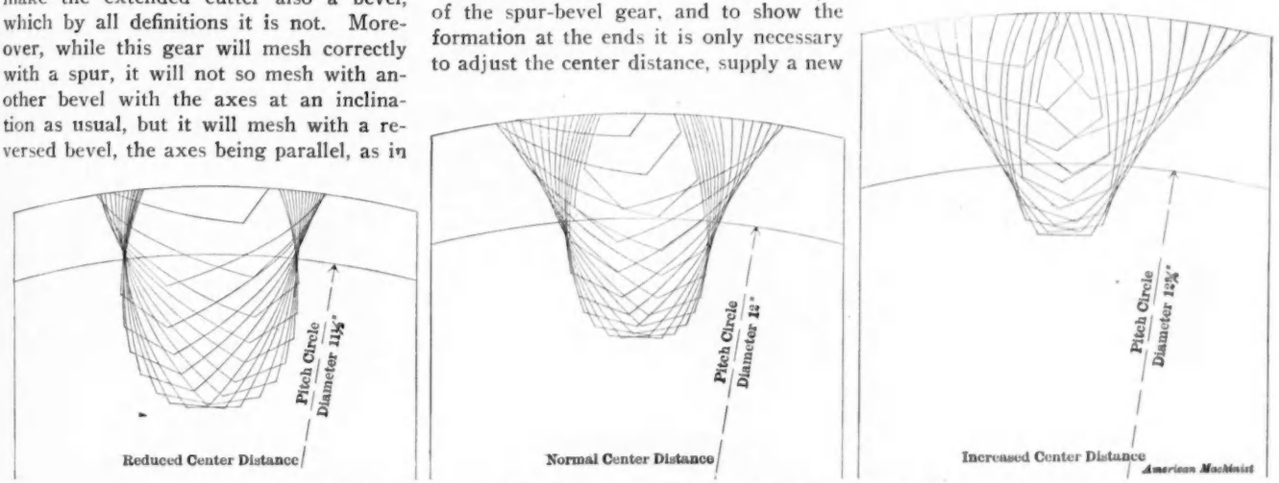


FIG. 4. EFFECT OF VARYING CENTER DISTANCES IN GENERATED TEETH—CUTTER OUTLINE UNCHANGED.

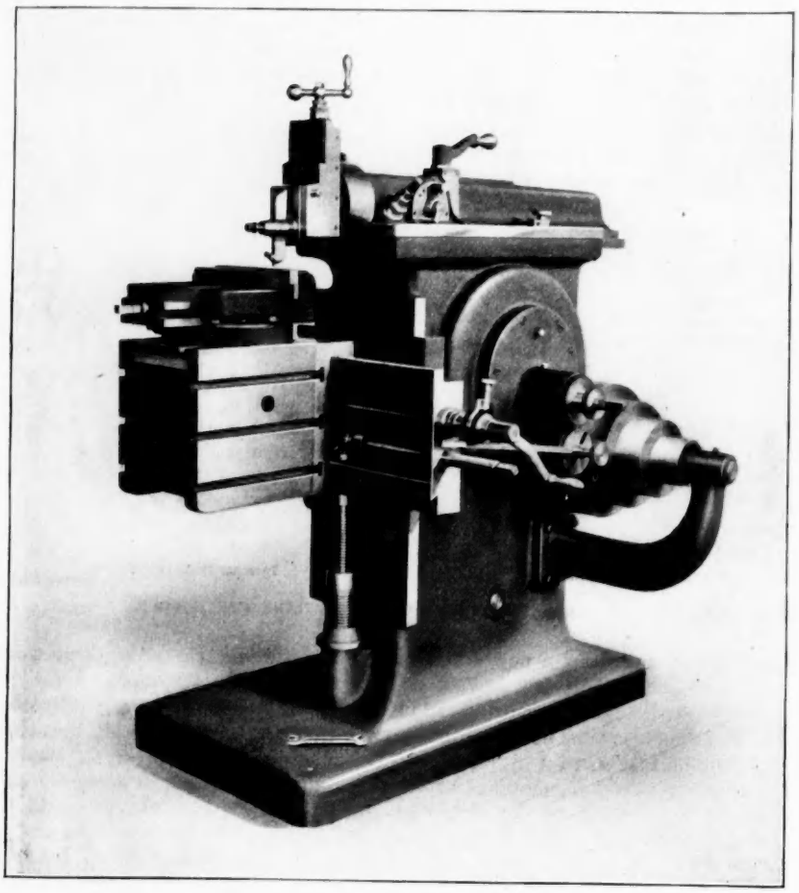
That such a gear is possible depends at bottom upon the fact that the involute gear has no fixed pitch line, in the sense in which that term is used in connection with an epicycloidal gear. Two involute gears in correct mesh have of course pitch circles of such diameters as are determined by the velocity ratio. If two such gears of, say, the same size be drawn apart, it is well known that correct action continues, but the old pitch circles are no longer tangent to one another, and new pitch circles are at once established, of such sizes as to be tangent, and this is what has occurred here in the case of the larger of the abnormal gears. There is, however, no back lash in this case, because the mating gear has been generated to meet the condition of increased center distance. Geometrically speaking, two existing involute gears might have their center distances decreased without affecting the correctness of the motion, though practically that is impossible, because of the jambing of the teeth. With these models this difficulty does not hold, because again the mating gear is generated to meet the condition of reduced center distance, the cutter tooth cutting a space of a proper depth and width to accommodate itself.

The diagrams also show the nature of the clearance curves at the roots of the teeth. The tooth profile proper will be seen to be a wrapped curve everywhere tangent to the cutter tooth profile, but the clearance curve will be seen to be of an entirely different character, being a traced curve traced by the point of the cutter tooth. It is because of this difference in the character of these curves that the line of union between them was so plain in the photograph of the actual gear, and not because of any angle at their union. The clearance curve being made by the point of the cutter, the feed of the machine is there distinctly visible in the actual gear, while the tooth profile should, and does, show no such feed marks.

The real difference between the three tooth curves shown in Fig. 4 is one of obliquity. But one involute is possible for a base circle of a given size, and the tooth profiles shown are all parts, but different parts, of the same involute. The diagrams show how the extent of the clearance curve depends upon the obliquity, this curve increasing in the small gear, in which the obliquity is small, and decreasing in the large one, in which the obliquity is large, and from this is seen one of the advantages which would follow an increase of the obliquity over the standard angle, as has been advocated by some of the best informed authorities.

The Stockbridge Shaper.

We give herewith illustrations of a new shaper that has some points of novelty and interest. The shaper has an unusually rapid return stroke which is secured by combining the two devices that are most commonly used for that purpose, and thus getting the effect of both. There is first the familiar Whitworth quick return by means of a crank placed eccentrically to the main driving gear from which it gets its motion, and then instead of this crank driving the ram directly by means of a connecting rod, as is usual with crank shapers, it drives through the medium of the slotted lever usually found in pillar shapers, and thus adds the accelerating effects of the two for the return stroke.



THE "STOCKBRIDGE" SHAPER.

We give an engraving showing just how the driving mechanism is arranged, and above the ram is a scale laid off with divisions showing the angular movement of the slotted lever for each 15 degrees of rotation of the main driving gear. This shows that the forward stroke of the ram is made while the wheel rotates through two-thirds of a turn and the return stroke during the rotation through the remaining one-third, and there is a point at which the return is over three times as fast as the cutting speed. It will also be noticed that the cutting stroke is a very good approximation to uniformity, falling off a little at the extreme ends only, where usually the cutting tool is out of the cut and where there ought, in fact, to be some retardation to avoid an unpleasant jerk at the moment of reversal. The irregularity of rate of movement is mostly in the return stroke, where it does no harm, and in fact is the better for it. Of course, the movement of the ram is not precisely the same as that of the slotted lever, owing to the angularity of the latter, but the difference is negligible, and the scale which is derived in the manner indicated on the drawing fairly represents the ram movement.

Another feature of this shaper which, though it is simple in its nature, is novel and interesting is in the double elevating screw for the knee. This is in two parts, as shown. The lower and larger portion can of course go down only until its collar contacts with the nut, while the smaller screw can enter the larger one only to the limit imposed by its collar. Then both screws are limited in their upward movement through their respective nuts; the consequence being that no hole has to be cut through the floor to permit the screw to pass through, and yet the screws take care of themselves as well as the usual single screw does, transferring the motion from one to the other automatically as required. The weight is carried on a ball thrust bearing.

The shaper has an automatic down feed for the head, which is very simple in construction and easily manipulated.

The vise swivels and is graduated, and has a swivelling jaw for holding taper work. Its screw is at all times entirely covered to protect it from dirt and chips. Graduated collars are provided on all traversing screws.

The shaper shown is of 16-inch stroke; the ram is 33¾ inches long, 7½ inches wide and has a bearing of 22 inches in the column. The table has a top working surface of 10x11½ inches, and two side surfaces 11½x12 inches. The box table can be readily removed from the saddle, which also has three T-slots for fastening work to it. The cross feed is 17 inches, vertical movement of knee 14 inches, and the feed of the head 6 inches. It is made for the Niles Tool Works Company, 136 Liberty street, New York.

Congress and the Patent Office.

Prof. F. R. Hutton, secretary of the American Society of Mechanical Engineers, has sent out to the members of the society a circular calling their attention to the interests of the United States Patent Office and indicating lines of action which they may pursue to promote pending legislation. The matter is one of as great interest to the general mechanical and engineering public as to any one society, and we therefore take pleasure in laying the matter before our readers.

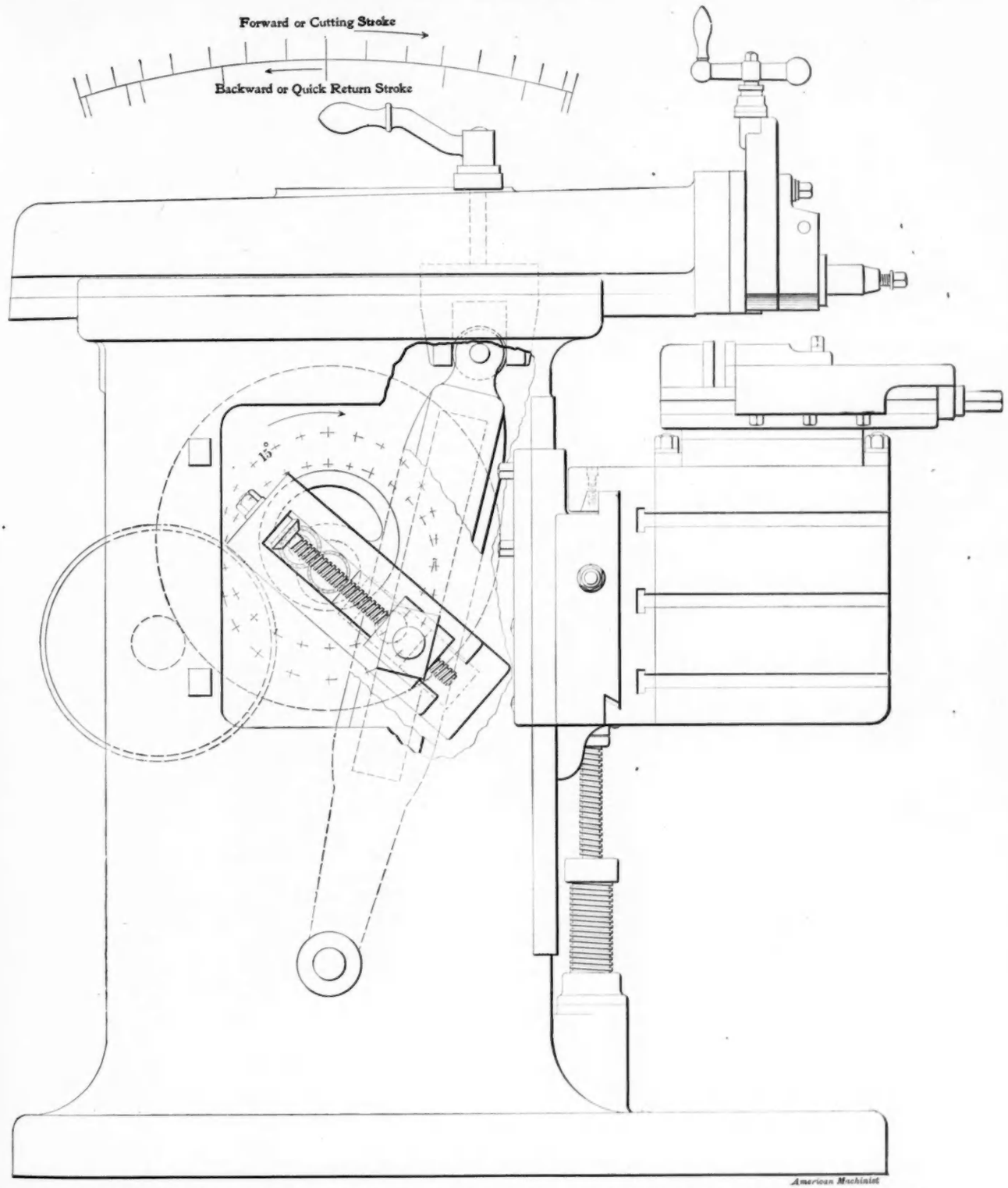
Attention is called to the resolutions adopted by the society at the Washington meeting, May, 1899. These are as follows:

"*Resolved*, That the association, as a body and through its individual members, urge upon Congress the necessity of relieving the present overcrowded condition of the Patent Office, and providing sufficient room, force and facilities for the prompt and proper execution of its work.

"*Resolved*, That we further urge that the records of the office, which so largely constitute the legal evidence of title of so many of the large manufacturing industries of this country, should be more safely stored, and that ample appropriations be made for providing incombustible receptacles for the records.

"*Resolved*, That we especially urge that the library of the Patent Office, upon which the efficiency and accuracy of the work of the bureau depend, shall have such ample appropriation for its extension in its special field, and for keeping it fully abreast of the progress in the mechanical and manufacturing arts of the day.

"*Resolved*, That this association urge the necessity of giving to the Patent Office the use of the entire building in which it is now located, and that the moneys



DRAWING SHOWING DRIVING MECHANISM OF THE "STOCKBRIDGE" SHAPER, WITH DIAGRAM SHOWING COMPARISON OF FORWARD AND RETURN STROKES.

paid into the Patent Office by inventors be applied, so far as necessary, to the uses of the office."

The circular then proceeds to suggest specific ways in which members of the society may help in the matter. Of course, others may do the same.

"The first way is that each member should write to the member of Congress from his district, and also to the two Senators from his State, laying before them the desire of the profession of engineering in its relation to the manufacturing interests of the United States, that the question of the Patent Office and its needs should receive favorable consideration. This may include the urging of favorable action upon the Daniels bill, S. 1159.

"The second, that by contributions to the technical journals and by conversation and addresses the members of the society should arouse a public sentiment as to the dependence of the industrial interests of the country upon the preservation of material which has accumulated in the Patent Office.

. . . . . .

"It will be recalled that in the early history of the Patent Office there was a certain hostility to it through the parts of

the country which were not closely related to manufacturing. This sort of hostility seems to have almost entirely disappeared, and with the cessation of hostility and by reason of the pressure of larger and stronger interests before the national Congress, the needs of the Patent Office are thrust aside. The office is not in 'practical politics,' as it is called, by reason of the prevalence of the merit system in its departments, long before the enactment of the Civil Service Law.

"In this view the interest of legislators can be excited in its behalf only through their constituents. Furthermore, the Patent Office, by virtue of its being one of the many bureaus in the Interior Department, has had to contend with a species of rivalry or discrimination, with the result that by reason of the continued growth and progress of the departmental work, the storage capacity of available areas has been crowded to the utmost. In some cases the weight of papers has reached a point at which further storage upon the floors is forbidden by the building inspectors, with the result that records which are titles to valuable manufacturing properties are crowded into passageways and elsewhere, where they are not only exposed, but where, in case of accidental fire, they could not be saved. Up to the 1st of January, 1899, 693,979 patents had been granted and 41,422 trade marks, labels, etc., had been registered. Last year 25,527 patents were granted and 2,260 trade marks registered. This accumulation has forced the galleries of the halls, originally designed for models, to be crowded with record matter, and the exhibition of models has been congested and made practically impossible.

"With respect to the library of the Patent Office, with its two departments of Science and Law, it is imperative that these should both be permitted to grow with the progress of the country's history, and both funds and space for this purpose are imperative. Less than $1,500 was available this year for the purchase of books for the Scientific Library, and no funds whatever were available for the Law Library. In the opinion of those competent to advise, a sum of not less than $6,000 per annum should be made available for the purchase of books.

"With respect to the last recommendation of the society, it is to be said that the excessive crowding of the departments of the Patent Office into areas in the available space, wherever that could be found, has forced departments of the office to separation over different floors and parts of the building, with manifest increase of the labor of its routine business, and therefore delay in rapid consummation of its important duties.

"If there are any further lines of information in your possession which would point to strengthening the case which you are asked to make, every member is earnestly urged to make use of them in presenting the matter most forcibly to those in authority, to influence legislation upon this important subject. The secretary will be glad to co-operate further with any members."

In the speech at Washington which seconded the adoption by the association of the action of its council, the mover called attention to the fact that the United States Government has two sources of income; one is that which comes from taxation, direct and indirect, and the other is its income from the Patent Office.

Casting a Six-Way Pipe Without a Pattern.

BY JAS. A. MURPHY.

There are foundries throughout the country that have often turned away jobs similar to the one that is the subject of this article for no other reason than that there were not brains enough in their whole concern to invent a "rig" or make the job without patterns. There are, of course, many specialty shops that it would not pay to handle such things; but there is no excuse for the jobbing shop that advertises to do all kinds of work to turn a customer away with a job that a good price can be gotten for.

Fig. 1 shows the six-way pipe about to be made, and aside from a pile of bricks,

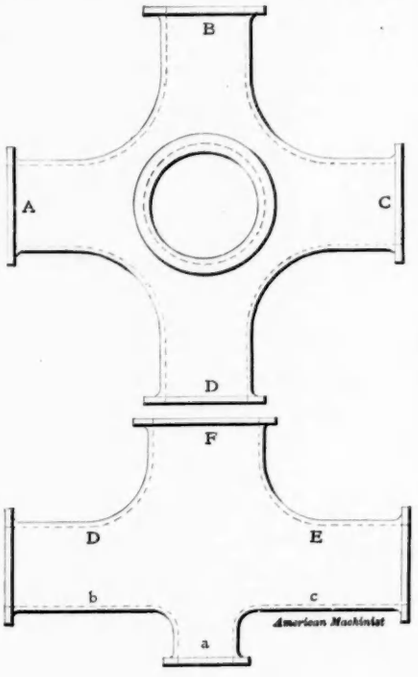


Fig. 1

THE PIPE TO BE MADE.

the first things that come under consideration are the "irons." The pipe was 8 feet long, the four horizontal branches 26 inches diameter, the upper branch larger than this and the lower one considerably smaller. The sketch is not made to any scale.

We will make the core first and use that for a pattern. Fig. 2 is a core-plate the full size of casting, with core bearings at the ends. The reason for making it so is that after the core is swept up a bearing will be all around the core so as to hold the thicknesses that

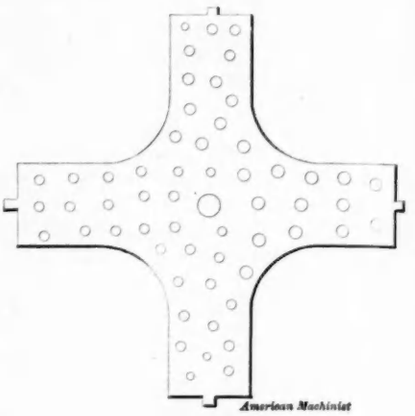


Fig. 2

are put on. Then comes the core arbor, shown in Fig. 3 with section of one arm. These are, as are all the rest of the rig, cast in open sand, and no pattern of any kind is required aside from the horn to form the semi-circular prongs on the core arbor. Two of these arbors will be required, one for the bottom half with lifting lugs on, as shown, and one for the top half without lifting lugs. Care should be taken to have the center prickers long enough and strong enough to carry the bottom branch *a*, or many would make a separate arbor and bolt it to the main "iron." The bottom plate is best made as shown in Fig. 4, although a round plate as outlined, or, for that matter, any other shaped plate big and strong enough would answer the purpose. There would, however, be waste of metal, and if the mold was built circular to conform to it, it would be too hard to dry, and there would be a waste of fuel as well as metal. The mold could be built on the round plate to conform to the outline of the mold, and a cope-plate as the one shown in Fig. 5 used. If a whole new rig is to be made, the bottom plate shown in Fig. 4 is the best and most convenient. All such plates as Figs. 2 and 4 should have plenty of holes cast in them to facilitate drying, and where the spindle is to be used a hole large enough in the center. Have some half flanges cut, as shown at *A*, Fig. 5, two fillet sweeps *B* and *C*, three sweeps, Fig. 6, and one whole flange, half of which is shown at *D*, Fig. 5, cut on lines so as to allow it to draw in easily when part *X* is first drawn. With four rough 1-inch plates to cover the top of the building, a small top plate to cover the part *F*, two gate sticks *A*, Fig. 7, and four riser sticks, we have about everything required.

The bottom half of core *a b c*, Fig. 1, must be first made, and we set core-plate, Fig. 2, in position, taking care to have it

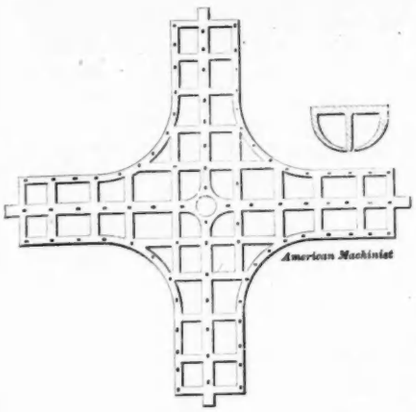


Fig. 3

THE CORE ARBOR.

level and the hole in the center perpendicular to spindle seat. Spread on the outer edges a good inch of loam and put on the core arbor, taking care also that while having it evenly set the center hole corresponds with the hole in the plate over the spindle seat. See that no prongs are too long by going over the arbor with one of the half flanges, eight halves of which are required. Build the four prints in arch form with whole bricks. Lay two or three rows of half bricks around the outer edge of the arbor to conform to the shape of the inside of the flange, and then fill up the body of the core with cinders. Secure the spindle and attach sweep *A*, Fig. 6, and build part *A*, Fig. 1, of half bricks. Loam the straight part of it, and the rest of the core can be made up of core sand. The flange will strike off the straight parts, and the piece *C*, Fig. 5, will be a guide on the turns. *B* will be used on the top side. After the core is well finished up set the flanges in their proper places and put some spikes outside them on the prints to hold them. They can be set accurately from the spindle, but it does not cost much to make a template, which would be a square with the center lines marked on it (Fig. 7), and it is best to have it. There is not a piece in the whole thing that a good molder cannot make himself.

When the flanges are secured and the core properly slicked up, get a square or oblong corebox (6x9 inches makes a nice handy size) and of the proper depth (in this case ¾ inch), and with some good, tough, new molding sand well moistened make some cake cores in the box. Turn them out on a flat board and lay against the core and drive in some small nails to hold them; as, if this is not done, they will fall off when the core is turned over. After the core is all covered with these thickness pieces put on a coat of slip and slick up nice and smooth; take off the flanges, and the core is ready for the oven. The bottom plate, Fig. 4, can now be set in position, care being taken to get the center hole right, as in the previous cases. Build four piers at *A*, *B*, *C*, *D*, Fig. 1, and sweep them level with an arm from the spindle. As the four prints of the core must rest on these piers, it is easily seen how necessary it is to have them perfectly level, and high enough to allow at least one brick and an inch of loam on the bottom under the branch *A*. When the half core is dry, it can be turned over with the cross or beam and slings and set on the piers. The best thing then to do is to put on the other arbor and clamp it to the lower one securely, after which build the top half in just the same manner as the bottom half.

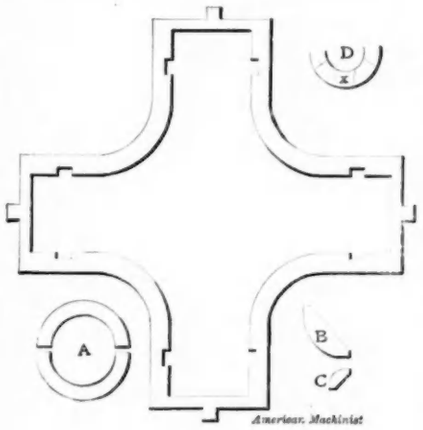


Fig. 5

COPE PLATE.

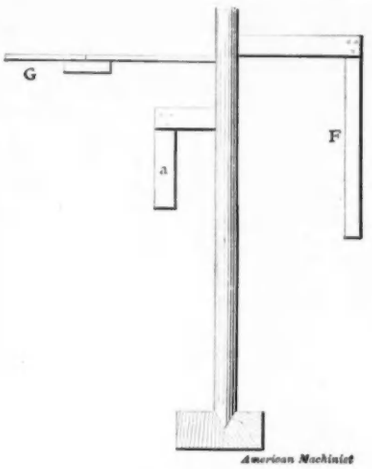


Fig. 6

THE SWEEPS.

Oil the surface of the bottom of the core, as well as the flanges, rub on some parting sand, and commence building under the core, continuing until the center is reached, where a parting is made and the cope-plate, Fig. 5, put on. Arch over the whole with bricks and loam in a reliable manner and from about the point shown in end view, Fig. 8, build square. Set the gate pins on the most convenient flange down far enough to prevent the iron in pouring from falling directly on the core, and put a riser on each flange. Build the mold in circular form around the top branch and sweep the flange with sweep *G*, Fig. 6. The mold is then built, and before lifting off the cope place a round plate on top of the top branch of the core and run a long bolt down through the hole where the spindle came out, and secure it to the bottom plate. This will prevent the top branch of the core from being broken or lifted away in the act of lifting off the cope. When the cope is lifted off it can be set on four stools, the ¾-inch thickness of sand scraped off, and finished "overhead." The core can be

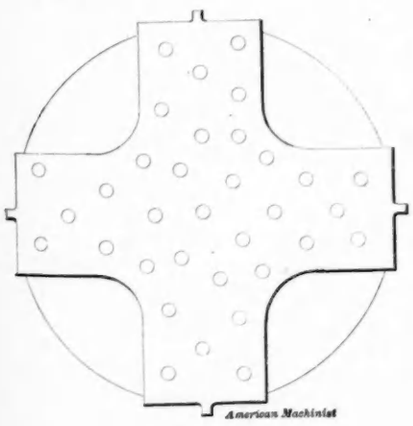


Fig. 4

BOTTOM PLATE.

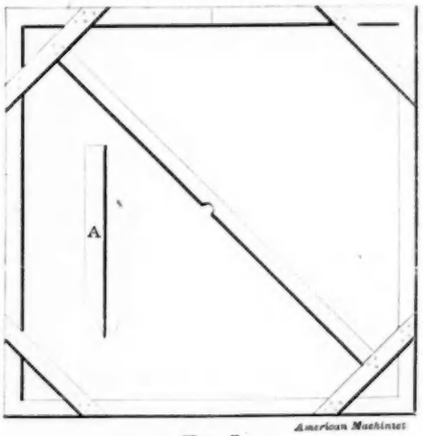


Fig. 7

TEMPLATE FOR SETTING FLANGES.

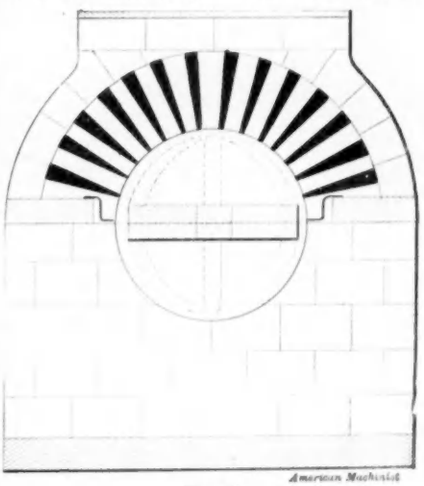


Fig. 8

END OF MOLD.

lifted out of the bottom half and all finished separately. When properly finished dry well in the oven, and the rest will be easy.

The Progress of the Mechanical Arts in Three-Quarters of a Century—I.*

BY COLEMAN SELLERS.

The greatest advance in mechanics has been accomplished since the advent of the locomotive. It so happens that the birth of the modern railroad system is coincident with my own birth. At that time the first railroad was put into operation in England, which development, taken in connection with the advent of the steamboat, which preceded it, was certainly the exciting cause of the great industrial advance that has since been made.

The traction engine applied to the railroad was the basis of our present wonderful system of inland intercommunication, and its development has given an impetus to all trades. In fact, the wants of the railroads taken alone would have been sufficient incentive for what has since been done in the mechanic arts, engaging, as they have, the attention of engineers to produce the labor-saving tools required for the improvement and preservation of the railroads and equipment, including the great iron and steel works that supply the rails, bridges and buildings.

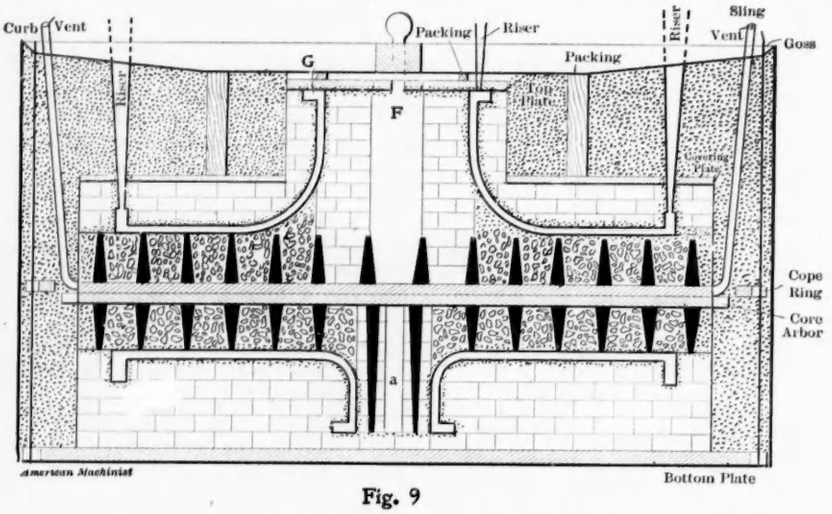


Fig. 9

VERTICAL LONGITUDINAL SECTION OF MOLD.

Special machinery has been constantly needed to render possible such industries as iron shipbuilding, bridge and structural work, and the appliances which have been introduced in place of hand labor throughout the industrial world. The progress of the single industry of machine tool building has, therefore, a most important bearing on this subject, and traced through the many stages of its rapid growth, the development of this one industry would be sufficient to illustrate the progress in mechanic arts during the period in question, and especially what has been accomplished in this country.

The important relation which tools and implements bear to the mechanic arts and, in fact, to all arts and crafts, forms the subject of an interesting tradition which was published in the "Journal of the Franklin Institute" by the late Mr. Joseph Harrison, Jr. In his home at Philadelphia he exhibited a painting by Schusselle, representing a blacksmith seated at the right hand of King Solomon's throne in his great temple, to illustrate a hypothecal event during the feast given in Jerusalem at the completion of the edifice. To this feast had been bidden the various artisans who had been engaged upon the construction and decoration of the building, those who had helped to shape the gold and silver and carve the ivory and weave the costly hangings that decorated its walls. There also came, unbidden and unrecognized, the swarthy smith, who, forcing his way through the courtiers and the guard to the throne of the king, claimed recognition as the one man to whom was due the creation of the entire work, for it was he who had forged the tools without which the other artisans could have done nothing. The wise king, recognizing the justice of the claim, gave to the smith the seat of honor. Antedating the smith of King Solomon's day and the mechanics of all times, the progress of civilization can be traced by the study of the implements used in the daily life of different races of man, and prominent in the progress of the mechanic arts must be counted the tools with which work has been accomplished.

As one instance of progress from primitive methods during the period under consideration, it may be of interest to refer to the construction of one of the first large engines that were built for the city water works in Philadelphia. There is probably no one present who can recall the fact from actual memory, but where our Public Buildings now stand there was once a smaller structure, on top of which was a tank into which water was pumped, and this water was distributed through the then small city below Broad street by means of wooden pipes of comparatively small size. The engine used in this work was, I believe, of the Oliver Evans type of high-pressure engine, the cylinder of which was cast in New Jersey. The boring bar used in boring out the cylinder was of the crudest character, operated by hand by means of levers attached to it, so that men walking around the cylinder could propel the cutting tools, and gradually force the cutters on the boring bar through the cylinder, until it had been turned out approximately true. After that the inner surface had to be filed to a sufficient degree of smoothness. Probably a month was consumed in this operation of boring the cylinder.

It may be of interest also to note that when the engines were erected and the boilers put in their place at this Center Square Station, the latter were found upon test to be insufficient for their purpose. Oliver Evans had specified the length of the grate bars and the width of the furnace to be used, as also the length of the boilers, which were of the plain cylinder type, but the wise men of the city government believed that they could do better by making the boilers much longer than he had suggested, and they were so constructed. Upon their failure to do the work, Oliver Evans, who was in New York, was sent for in haste to correct the difficulty. His message to those in charge, enforced by his presence afterwards, was that they must cut off 10 feet from the length of each boiler. This seemed a strange proceeding, but he soon explained to them that the extra length which they had added to his prescribed dimensions was acting as a condenser to re-convert steam into water, inasmuch as the heat of the furnace could not extend the whole length of the boilers as they had been built. Upon cutting the boilers down to their proper size so that the heat could extend over the whole fire surface, they proved sufficient for their work, and continued to operate as long as this primitive water plant was in existence. I have this story from those who were living at the time.

My first knowledge of physics came from my father, through his instructions and experiments for my benefit before I had fairly passed out of the stage of infancy, for I was but seven years old when I lost so able a teacher. As a schoolboy most of my holidays were spent in his machine works at Cardington, near Philadelphia, where I had abundant opportunity to not only know what was being done at that time, but I had from my seniors

* An address, slightly abridged, delivered in Convention Hall, National Export Exposition, Philadelphia, Thursday, October 5, 1899, on the occasion of the celebration of the seventy-fifth anniversary of the Franklin Institute.

the history of what had immediately preceded my personal observation.

My acquaintance with the rapid advance in the railroads of America, and in the motive power on the roads, dates from the time when the building of locomotives was undertaken in my father's shops, immediately after Matthew Baldwin had started his works in Philadelphia. When I was nineteen years of age I accepted service as draftsman in a rolling mill in Cincinnati, where rails were being made for the roads then projected through the Western States. The rails used at that time, which were called strap rails, were flat bars of iron about 3x1¼ inches in section, with oval depressions rolled into the face to receive the head of the spikes driven through the rail to fasten it to string pieces of wood. They were punched at each one of these depressions, which marked the location of the spike hole. At that time the most common accident on the railroads was one unknown now, namely, "snake heads," as they were called, when the strap rails, by the action of the wheels upon them, would curl up, drawing the spikes from the wood, often piercing the bottom of the car, and not infrequently killing or injuring passengers.

After my experience in the rolling mill, where I acquired a knowledge of the wants of the railroads, I was engaged for seven years in locomotive building, first in constructing engines for the Panama Railroad, in connection with one of my brothers, who was the inventor of a locomotive for ascending inclined planes. The late John C. Trautwine was the consulting engineer of the Panama Railroad, and it was on his recommendation that these engines were ordered, in the belief that some heavy inclines would have to be overcome in passing from the Atlantic to the Pacific Oceans at Panama, although these inclines were avoided, and the engines eventually used in the construction work merely.

Subsequently I entered the locomotive Works of Niles & Co., of Cincinnati, as foreman for five years, until 1857, when I accepted service as chief engineer for William Sellers & Co., of Philadelphia, then, as now, engaged in building machine tools. Thirty years' active experience in machine tool building enables me to speak from a full knowledge of this industry and what machine tools have done for the advance of mechanic arts. When engaged in locomotive building in Cincinnati I introduced a number of improved methods, but was hampered continually for the want of machine tools powerful enough to do the work as I desired it done, as well as for the want of special tools not then available. At that time in the Eastern cities certain machine tools were being built with success, and were doing far better work than it was then possible with tools built in a branch of the locomotive works where I was engaged. The firm of Niles & Co. had, however, some reputation even then as builders of machine tools and sugar machinery, but it was not until the retirement of the original founders of the house that the works became devoted wholly to the machine tool business. At the time I speak of, slotters, horizontal boring machines and lathes of various kinds and quality were built in America after the introduction of the planing machine, the first one of which was probably introduced into the city of Philadelphia some time about 1830.

The early machine tools were of the crudest workmanship, and most of the lathes were made partly of wood. In fact, the transition from wood to iron in the construction of machinery was in progress during the early part of this century, and the formation of the tools themselves and much of the machinery built at that time involved the conversion of structural shapes required for wooden machines into similar shapes in metal. In the first change from wood to metal, architectural shapes and ornamentation were considered desirable to make machine tools and other machinery meet what seems to us now the rather barbaric taste of those who were to use them. The same might be said of locomotives, which, almost up to the sixties, were elaborately decorated with paint, polished brass and scroll work. England gave us the first good machine tools, and set the example which has tended to simplicity in design. To that country we owe much that is valuable, not only in the direction of self-acting machine tools, but also in the various appliances for improving the character and quality of work to be accomplished. Thus, Sir Joseph Whitworth, one of the earliest makers of superior machine tools in England, aimed at utility and not ornamentation in the improvement of his products. It was he who introduced surface plates for producing other plane surfaces by means of the scraper; that is to say, after a surface had been made comparatively true on the planing machine, it had yet to be brought to a commercially true plane by a process of scraping off the higher projections, until, when tested by one of the Whitworth surface plates, it seemed to touch at intervals of not more than ¼ inch.

After scraping had come to be recognized as the only means of making true plane surfaces, there followed, unfortunately, a form of deception that exists, I am sorry to say, not only in America, but still more prominently in some of the copies of American machine tools produced abroad, namely, the practice of scraping the surface without any special regard to the purpose for which the operation is intended, but rather to give it the appearance of having been carefully fitted, and the surface so produced was very aptly called by the late Mr. William B. Bement, of Philadelphia, "bedquilt scraping." The parts touched by the scraper in this imitation work are very often not irregular in design, but constitute a set figure or pattern, which cannot deceive the eye of those familiar with good work.

Long before the time of the International Exhibition of 1851, America had begun to take her place in machine tool building, under a clearly distinct line of thought that was for a long time not appreciated in other countries. When visiting England in 1884, I was shown a copy of an American planer adapted to planing the stub ends of connecting rods for locomotives, there being two sets of uprights and two crossheads with four tool holders adjustable in position, to enable both ends of two connecting rods to be planed simultaneously. The American tool from which the idea was taken has its crossheads facing one another, and the table is speeded to run back and forth at the same rate of cut. By this means the machine is made to take a cut at each forward and backward movement of the table. The English machine had its tool holders facing in one direction, and all four cuts were taken at one and the same time only when the table was running forward, no work being done on the back stroke. The power of the American machine was therefore double that of its English copy, all other things being equal, and the maker was astonished when this was pointed out to him.

This one example shows how difficult it is to copy the machinery of another country if the coypist does not grasp the controlling idea of the mind that gave life to the original. Instances of this are found in many other directions where American contrivances, having obtained a world-wide reputation, are less efficient in the foreign copy than in the original production.

The planing machine is an invention well within my own experience. In the beginning it had the platen, upon which the work is fixed, dragged backwards and forwards by a chain. The first planer that Williams Sellers & Co. purchased and put into use was one of this chain pattern, and one was introduced in my father's shops when he undertook to build a locomotive in 1834. At the time of the Vienna Exposition, where machine tools from Philadelphia were exhibited, the engineers sent by the British Government to Vienna to note the progress that was being made noticed the broad feed cut on all the planing machines, lathes and tools that came from all parts of America, and remarked upon it as "producing good effect," as "looking well," etc., as if it were for appearance only, not knowing that it was a principle that had been established in America, thoroughly understood not only by the managers of the works, but by workmen all over this country, and uni-

versally adopted as necessary to good work.

I have already referred to the slow process of boring cylinders for pumping engines. When the early locomotives were built, for example, in the Niles Works, in 1856, the boring of the cylinders was done on a 36-inch lathe with a horizontal boring bar, and without any knowledge as to the theory of boring in order to produce the best results. It always took two days to bore the cylinder of a locomotive of the size in use at that time, and I think the largest cylinders were not over 15 inches in diameter. In Philadelphia, when Baldwin's had advanced to a very large establishment, they still bored the locomotive cylinders in the same way. It was not until shortly before the Centennial Exhibition of 1876 that attention was turned towards the utilization of a theory that had obtained in limited practice some years before as to the improvement in boring metals, the idea being that the quickest and best work can be done in boring by making the roughing cut with a fine feed, removing as much metal as possible by depth of cut, and making the finishing cut with a very broad feed but light cut that would let the cutter pass through the hole to be bored as quickly as possible so as not to wear the cutting edge in passage. That principle was first introduced when Mr. Asa Whitney, of this city, discovered that chilled cast-iron car wheels could be made to compete with the best wrought-iron ones and do a greater mileage. If the wheels cast in an iron mold were not allowed to cool naturally, but taken red hot from the chill, were put into the annealing furnaces and brought up to a heat a little below the melting point, and then allowed slowly to cool, they were found to be free from all internal strains, while wheels taken red hot from the mold would burst into three or four pieces in cooling, showing that there was violent internal strain in metal cast in that way under the tension of the heavy chill on the outside of the tread of the rim. The problem of boring chilled wheels was solved by taking advantage of the fine roughing cut and coarse finishing feed. Mr. Whitney desired to have wheels made interchangeable in their fit on the standard axles, so that when a wheel was fitted on an axle at a workshop in Philadelphia, another wheel could be furnished to fit that same axle at any future time, and just as well as the first one.

When the late Mr. Hudson had charge of the Rogers Locomotive Works he applied to the firm of William Sellers & Co. to have a special locomotive cylinder boring machine designed and built, saying that he had seen a boring machine designed by Mr. Grant, of the Grant Locomotive Works, capable of boring a 19-inch cylinder in nine hours. The matter was referred to me, and when I came to calculate the theoretical time required for boring a cylinder of the size named, on the supposition that the speed of 16 feet per minute might be used in making the cuts, with a fine feed and a deep cut for the roughing cut, and a shallow cut and a much wider feed for the finishing cut, I found that the estimated time amounted in all to only three hours, and named three and a half hours as not only possible, but what might be guaranteed as the productive output of such a machine. An order was given for this machine, it being understood that it was not only to bore the cylinders, but to counterbore the ends for the clearance of the piston, to cut off the sinking head and face up the flanges at each end of the cylinder. When completed, the first test was made with a 19-inch cylinder of hard close metal. This was bored in three hours and twenty minutes, exclusive of the time of setting the cylinder, which was not much on account of the peculiar arrangement of the machine, and the facility with which the cylinder could be put in place for boring. In this case the cylinder stood still, while the boring bar travelled lengthwise, carrying the cutter head with it, and upon the two face-plates of the driving heads of the machine were arranged automatic slide-rests that faced off the flanges. In this design there was no guesswork, as the principle of fine feed and deep cut on roughing, with very coarse feed and shallow cut for finishing, was in common use in all operations of boring, turning and planing metals, with exact knowledge as to what result was obtainable when the possible speed of cut per minute had been predetermined for the hardness of the metal to be tooled.

Since the time when I first related the incident of the rod planer in a paper published by me in the "Engineering Magazine," in 1892, even this tool, useful as it is, has been superseded almost wholly in locomotive works by improved milling machines. It is not my province to detail step by step the advance that has been made in machine tool building, but, as stated at the outset, I wish to make this industry illustrate the advance in the mechanic arts, and in connection with it I must call attention to the relative condition of the skilled workmen in America and in other countries. We owe much of our progress to our common school system, to our freedom from precedent and to our just patent laws. I do not wish in the slightest degree to decry what has been done abroad, for I myself have been a close student of the progress of the mechanic arts the world over, and have been only too glad to recognize and avail myself of all that is good and worth adopting, assuming at the same time that improvement is possible and absolutely necessary in many cases to adapt the machinery designed abroad to the conditions that obtain in American workshops. The tendency to standardize everything is peculiar to this country. Builders of locomotives in America adopt standard sizes and types of locomotives, and are thus able to manufacture such to great advantage. Railroads in America are willing to take from the builders what has been shown to be good and effective, and when the same kind of machine is to be duplicated many times, the maker can afford to invest heavily in special gages and special tools that decrease the amount of manual skill required in laying out the work or working to drawings. The first time a piece of work is done, whether it be small or large, simple or complex, more time is spent upon it than after the workmen have become familiar with its construction, and certainly more time than would be required after special appliances have been invented and made to cheapen the product, especially when the men are paid for their work according to the quality and quantity turned out, and not by a fixed wage per diem. I allude to this because I know it is the custom of foreign railroads to submit to builders in England and America specifications for engines that cannot compete in economy of construction with those that are built in quantities in the way that I have just mentioned. It is the recognition of this fact that is now opening the markets of Europe to American locomotives as they are built and as they are used in America. A celebrated builder of locomotives in England told me that the rules of the Board of Trade and Parliamentary regulations for the safety of the people crowded their locomotives with useless appliances. A close observer of railroad machinery, who is familiar with the principal railroads in the world, has stated that if a locomotive builder abroad is given a new problem, such as to construct a hill-climbing freight engine, or a goods engine as it is called abroad, or even an express passenger engine for mountain districts, a completed machine may be the result that is a model of strength and durability, but inaccessible in the extreme when ordinary repairs are required. It is easier to take out the cylinders in an American engine and replace them with new ones than it is to reset the valves on the type in general use abroad, where the valve chests are crowded together under the smoke-stacks as though they would never require adjustment or resetting. The persistency evinced in adhering to the crank axle in English engines, in spite of its weakness, is one of the matters not understood in this country. Give accessibility to the valves, and ready access to all the parts, and the whole engine will be better cared for by those in charge of it.

Tinning Process for Iron Ware.

We have been asked many times for information regarding tinning articles, especially castings. The following description of a tinning process is authentic and up to date, and is the only one we know of that has been made public:

First, clean the drawn or stamped iron

parts carefully in a pickle made by taking three gallons of vitriol to which add two gallons of water. Heat this mixture by coiled steam pipe, very hot, in a tub or iron kettle or wooden tank, zinc lined. Pickle articles until clean. Experience alone will teach the time required, but say 10 to 15 minutes, according to the age of the solution, will be about right.

The size of the vat is approximately 2½ feet wide, 4 feet long and about 2½ feet deep, 2-inch wood and zinc-lined. It has an inside cage, or box, hinged on a bail, which connects it with a chain and pulley, which raises and lowers this cage by means of a windlass fastened to a frame on the outside of the vat. Into this cage the articles for pickling are put, for quick handling. When the cage is full it is lowered by means of the windlass into the vat which contains the pickle and allowed to remain there until cleaned.

After removing from the pickle vat the articles are placed in a second vat, which contains clean, cold, running water, which kills the pickle.

A second rinsing is now given the articles in hot water, which cleans and dries them.

The acid bath may be made by cutting a 42-gallon barrel in two. Partly fill with a solution of muriatic acid which is weakened by the use of spelter; one gallon of acid allowed to consume one pound of spelter makes the proper proportion usually used. The articles are now placed in the bath and remain there from three to five minutes, according to the time the operator takes to tin them, which is the next process.

The articles are now ready to take their first coat of tin upon the iron surface. This first coating of tin does not leave the articles in a clear, bright state, but rather in a dull-looking condition. It is, however, necessary to get a good surface or foundation for the final retinning, which will be explained in its proper turn. In this first tinning many pieces are sometimes tinned at once for the sake of rapid production.

The tinning furnace is of cast iron, as regularly made for such work. Door frames, grates and cast-iron trimming are set in brick work, with a suitable melting pot over the furnace, which is heated by burning common hard nut coal. The size of the melting kettles used depends upon the size of work done. The one used in this case was about 3 feet long, 2 feet wide and 18 to 20 inches deep, well filled with melted block tin of good quality. This is kept very hot and tins the article quickly. Less than one minute will usually tin an article of quite large size. A paper hood is placed over this melting pot to carry off all the impure gases which arise, keeping the air clear and pure in the room. After taking the articles from this pot they are spread about on a long wooden table, or bench, and allowed to drain and cool, and the tinning to set. This ends the process of first tinning. They are now ready for their final or second retinning process.

RETINNING.

Articles stamped from tin plate lose their lustre in the process of manufacturing, which makes it necessary to retin them, and this is done as below stated:

There must be a furnace for tallow. This is a common furnace, over which is placed a cast-iron kettle 24x24 inches and 18 inches deep, which is kept well filled with melted tallow of the commonest kind (condemned or rancid oleomargarine is sometimes used, which answers the purpose very well). Palm oil is sometimes used, but owing to its expense a cheaper substitute in the tallow is now almost exclusively used. This melted tallow is kept very hot, its object being to open the pores of the articles to be tinned so that they will be filled with new tin easily and quickly. The articles are allowed to remain in this vat from five to eight minutes, and are piled into it in quantities, so that they will become thoroughly heated. When taken from this vat of tallow their appearance is very black and dirty, but this soon disappears in the next operation.

The retinning vat is of the same size and form as the tallow furnace vat, only that it is filled with pure, best quality block tin melted and kept as hot as possible. The articles are submerged in this tinning vat, where they are turned over several times by the operator, to allow them to get an even coating of tin.

They are then dipped into a second tallow vat, which is in construction and size the same as the first tinning vat. This operation seems to set the tin coating and give it a clear, bright appearance. Being now removed from the second tallow vat, the articles are placed against a draining rack, which allows the tallow to drain into a proper receptacle and remain in a melted state, and at the same time allowing the coating to set on the article so that it can be handled for scouring off the remaining tallow, which is done with sawdust.

While the articles are still warm they are taken from this draining rack and placed in a box on legs, which contains fine cedar sawdust. With this sawdust they are cleaned from the remaining tallow, and the lustre begins to appear, the cleaning being done by boys, who rub the articles with a soft felt glove, which does the work quickly. This sawdust is very fine and soft, so that the gloss left on the articles shall not be scratched. This sawdust box is about 4 feet long, 2½ feet wide and about 18 inches deep, and is nearly half filled with the sawdust.

The final high-polish gloss is now secured, which is the last handling. This is done by taking the articles from the sawdust box and placing them in the flour box, which is about half full of fine common flour and the finest of the cedar sawdust, mixed in about one pound of sawdust to ten pounds of flour. The articles are carefully rubbed in this mixture with flannel or other soft cloth. This finishes them so that they are ready for inspection and packing. Sometimes it happens that the articles are not perfect. These are thrown out and are again retinned, usually coming out all right the second time. This retinning leaves a beautiful, bright, clear lustre.

The process described requires the following: One building one story high, 50 feet long and 30 feet wide, with common electric or other power exhaust fans at each end of the room to purify the air.

One pickle vat, two rinsing vats, with necessary clean-water piping and steam-heating coils for hot water; one acid bath; one tinning furnace for first tinning iron stamped ware, and for retinning a series of four retinning furnaces and vats, as follows: one tallow vat, one block tin vat, second tallow vat, one draining vat, two cleaning sawdust boxes, with bench along one side of the room for storing goods. One operator for each handling is required. Common cast-iron furnaces and kettles set in brick work. Anthracite nut coal is generally used for heating; there is no objection to gas or other methods, except their expense. Vitriol, 3 parts, and water, 2 parts, for pickle; use hot. Acid bath—muriatic acid, 1 gallon, and spelter, 1 pound, dissolved. For first tinning good, fair block tin is used. For retinning very best block tin is used. Tallow vats; commonest kind of tallow; sawdust. Fine cedar sawdust for cleaning. For lustre, fine cedar sawdust, 1 pound, and common flour, 10 pounds. The operations are very rapid by experienced hands. F. C. F.

Old Phonograph Records for Rubbing Tracings and Drawings.

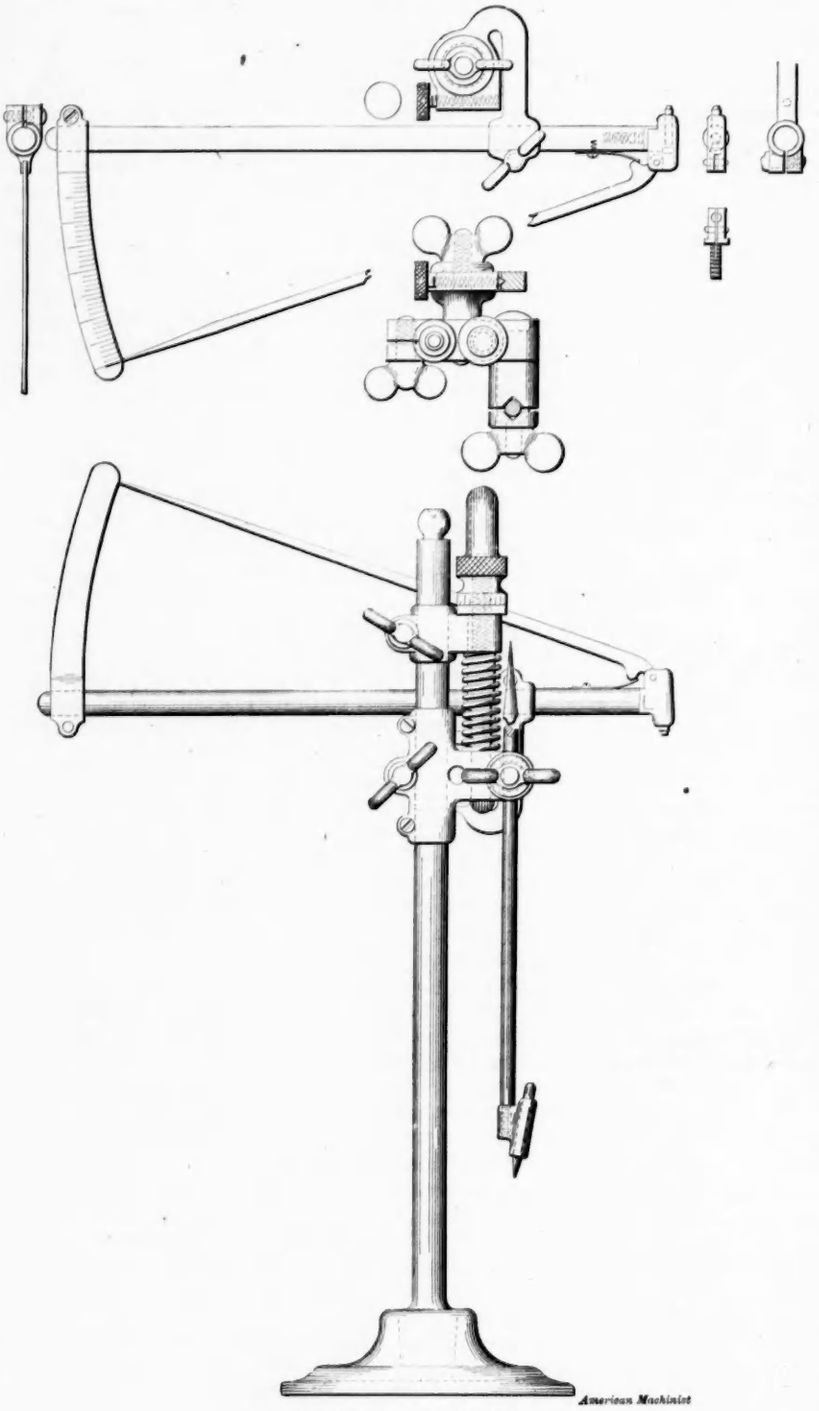
It frequently happens that mistakes or changes require the erasing of lines or letters on a tracing, and while this may be neatly done with a sharp eraser, the glaze on the cloth is destroyed and, no matter how carefully the tracing is handled, the roughened portion catches the dirt, its beauty is soon gone, and it will not make clear prints.

Mr. Russell T. Kingsford, chief draftsman of the Rushmore Dynamo Works, Jersey City, has discovered that the glaze may be restored to the cloth after using the eraser by rubbing over the roughened surface with a piece of hard wax from an old phonograph record cylinder. The surface thus produced is superior to that of the original glaze, as it is absolutely oil and water proof.

In the Rushmore Works all pencil drawings that go into the shop are first rubbed over with this wax, and it has been found that while common pencil drawings are soon destroyed by dirt and grease, those treated with the wax return to the drawing room after the completion of special jobs without the slightest blemish.

A Surface Gage and Indicator.

The accompanying cut shows a surface gage and indicator with a number of features not usually embodied in such instruments. It will be noticed, in the first place, that the post or spindle has a taper fit in the base, the latter therefore being



A SURFACE GAGE AND INDICATOR.

removable, and, as there is a good center in each end of the spindle, the instrument may be used upon the lathe centers as well as upon planers, shapers, milling machines, boring machines and elsewhere. The scriber used, it will be noticed, is shown in the sketch with a minute prick punch in the lower end of it. This punch is normally held up against a shoulder by a little helical spring, a tap with a light hammer bringing it down to make its mark when required. The scriber may usually be set in such a direction as to bring the prick punch perpendicular to the surface with which it is at the time concerned. The scriber is of course reversed end for end when lining is to be done.

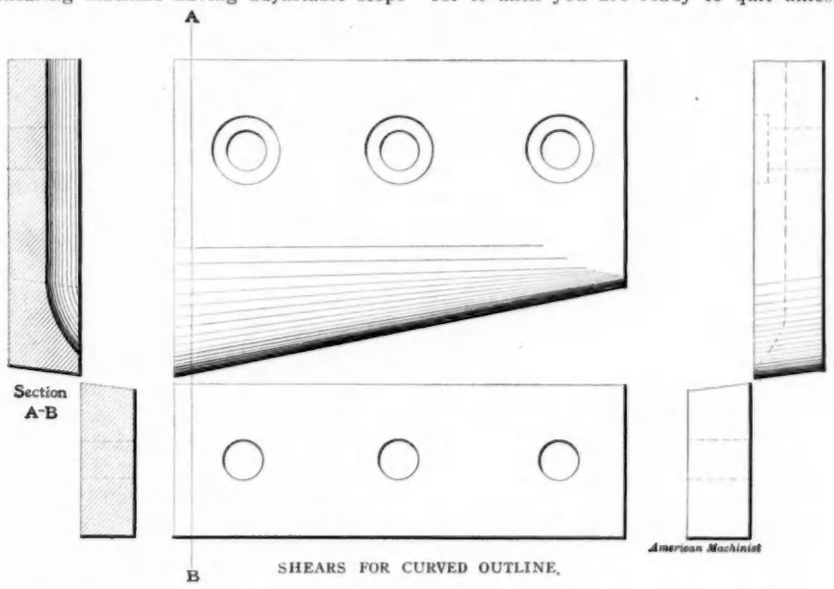
Upon the spindle are fitted the two split sleeves which may be clamped at any point by their respective screws. The upper of these may be called the fixed sleeve, and the lower the adjustable sleeve. These sleeves are normally held apart by the compression spring and drawn toward each other in opposition to the spring by a long stud or fixed screw attached to the lower sleeve and a milled-head nut fitted to it, which bears upon a shoulder on the upper side of the upper sleeve. The thread of the screw is 40 to the inch, and the periphery of the nut having 25 divisions, the reading is in thousandths of an inch. The nut is extended upward into a closed thimble which entirely covers the end of the screw. The upper sleeve being clamped securely, the screw of the lower sleeve may be loosened just enough to permit the lower sleeve and its appurtenances to be moved, and the movement is indicated by the reading of the nut. The adjustable sleeve carries the scriber in front, which may be clamped in any position, as shown. At the back it carries a mounting for the surface indicator, which is used for inspecting and indicating the minute variations of plane surfaces. The rod of the indicator may be slid endwise in its mounting as required, and it may also be reversed, as shown in the upper figure. The indicator consists of a little vertically moving hardened-steel plunger the inner end of which bears against the short end of a spring-actuated lever, the long end of which is a finger which traverses the graduated quadrant, giving readings to thousandths of an inch. The mounting which carries this indicator is bent upon itself so as to form a long slit or opening and to permit the piece to be sprung apart by the pressure of the horizontal milled head-screw seen in the upper figure. This screw is used for giving a minute movement of the indicator when required to bring the reading of the finger accurately to one of the graduation marks, or, when the indicator is used in connection with the scriber, to bring them both to coincident graduation marks. The applications of this instrument will suggest themselves to those who are familiar with the cruder instruments of the same class. It is made by C. P. Birner, Milwaukee, Wisconsin.

A Proposed Shear for Curved Outlines.

Reinhold Bettermann, of Johnstown, Pa., sends us a photograph and a description of his improved form of shears for cutting sheet metal. Mr. Bettermann is a boilermaker and states that he has experienced the usual difficulty in cutting the edges of boiler plates and sheet-metal work generally, to a curved outline such as is required for dome fitting, etc. The usual method is to lay out the curves and punch a series of holes as near to it as possible, then trim the plate with a chisel. He proposes to use shears made as shown by the accompanying sketch and to use them in a machine which, when curved work is to be done, can be given a very short stroke; and, the upper shear being

cut away above the cutting edge, permits the sheet to be turned as the cutting proceeds, so that either convex or concave curves may be formed, and a photograph which Mr. Bettermann sends us, but which is not very well adapted for reproduction, shows that the curves are thus produced quite smoothly, and Mr. Bettermann says it results in very great saving of time as compared with the usual method.

Mr. Bettermann's scheme includes a shearing machine having adjustable stops on the slide, which stops are adapted by a system of levers to reverse the motion of the machine, and thus a stroke as short as may be necessary for the work in hand can be readily obtained. Of course, it is apparent that these shears cannot be as strong as those made in the usual form, and as Mr. Betterman's drawing of a power shear shows that the belt and flywheel torque are transmitted through the friction clutch, by means of which the motion of the slide is reversed, no very heavy cutting could be done by it. It is evidently adapted to light work only.



SHEARS FOR CURVED OUTLINE.

Letters from Practical Men

"The Salary Expected."

Editor American Machinist:

"O. Mye's" friend R—— must be a very modest sort of a chap, from "O. Mye's" statement of the case; but although virtue is said to be its own reward, I have never heard that excessive modesty is. If R—— waits until a president comes around and begs him to accept more salary, his expected raise will not soon materialize. About two-thirds of the men I hear saying that they don't have the opportunity that others have to get good pay, will, when the opportunity presents itself, fail to get it through lack of "sand" to insist on having what the job is worth. They act as if it were the only job in the country open to them, and as if it meant starvation not to get it at some price. What was it that finally got for Mr. Clegg the pay he wanted? Nothing but independence enough to refuse to go to work for less than he considered the position worth. Moreover, had he taken it on a promise that his pay might be raised after a while, he would have had to fight it out again, even if it came at all. I hold it a good rule, when you have a position and think an advance due you, not to ask for it until you are ready to quit unless you get it. I've tried it that way a number of times, and it seldom failed to work. I know of a lot of men that think it a fine thing to get to be foreman of a place and to furnish the brains generally; but, having had a try at the foreman business, I have made up my mind that unless the pay is enough to make the place very desirable, the honors may go to someone else, as I'm not looking for them.

FLORIN.

A Compound Friction Roller for Oven Cars.

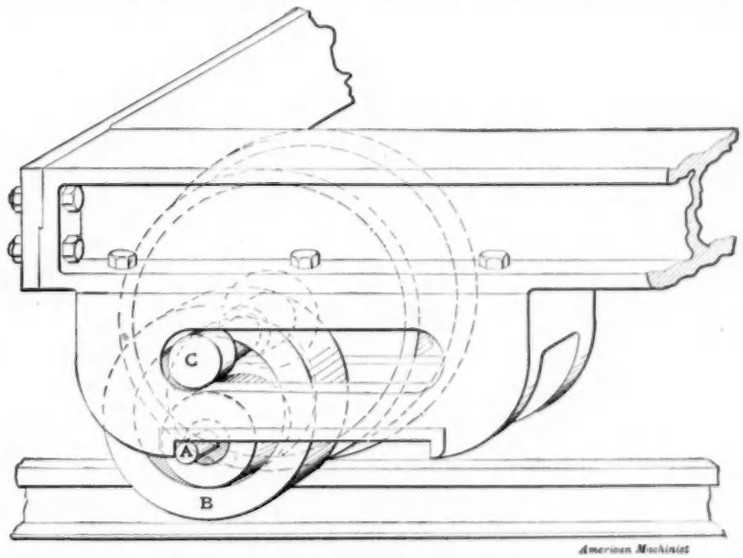
Editor American Machinist:

About seven years ago I was requested to get up a bearing, suitable for a car to be used in a heated oven, the temperature of which was about 300 degrees Fahr. Of course, oil or any other grease as a lubricant could not enter into the calculations, consequently we struck out on the total-abstinence principle, and the sketch herewith represents the outcome.

In the first place, our car was only about 6 feet long, and the travel in and out of the oven was about 60 feet—*i. e.*, from stopping place outside to the stopping place inside of the oven. This distance between stations and the shortness of our car precluded the utility of the plain rolling axle; so we compounded the rolling principle, and we have a car that runs so easily that it will not stand unchocked on an even grade of 3 inches in 100 feet, although the bearings are perfectly dry and subject to dust and weather.

Referring to the sketch, you will see the pin *A* through a small roller has a bearing on each side of the roller, and rolls along a planed surface practically on the bottom of the car. The roller rolls in ring *B*, which hangs and rolls on the main axle *C*, all of which we hope will not only be plain, but of some value to some of your many readers.

BOW PEN.



COMPOUND FRICTION ROLLER FOR OVEN CARS.

Progress and then Retrogression in Factory Management.

Editor American Machinist:

In the editorial, "A Bit of Foreign Experience," in your issue of January 18, the remark "They have yet to learn that a factory either progresses or falls behind" arrested my attention. Mr. Editor, did you never see a factory go both ways? I think I have. A number of years ago I was in a factory which it was a pleasure

to a mechanic to enter. This does not mean that it was an architecturally ornamental establishment, either from the outside or the inside. I mean in the way of handling the work. The building was a small three-story affair, and the article manufactured was a small patented article used in large quantities. Both the article manufactured and the system of manufacture were the result of one man's ideas. All of the stock when taken into the building was first elevated to the top floor. There it was processed and run through the first machines, and dumped as wanted into hoppers with spouts leading to machines on the floor below. There it was machined again and finished, put in the proper packages and sent down to the first floor for shipping. Everything moved along in smooth progress from the entrance of the stock to the exit of the finished goods, and anyone could see that the man who planned this little plant carried the brains of a manager under his nat.

Some years after, on seeing the same establishment, a great change was noticed. The business had "waxed fat," and the little three-story building would have been easily lost in the group of buildings that now appeared; but if one entered the place, shade of the "Pennsylvania Railroad!" what a change in system, or rather, what a lack of it! The head that planned the first plant had been kept busy in other channels, and it was very evident that the shop management had fallen to the lot of an entirely different kind of a man.

The raw material and the goods in the process of manufacture traveled up, down, sidewise and cat-a-corner-wise numberless times before it finally got out of the door again, and the elevator was the hardest worked machine about the place. For example: One of the materials used was stored in the basement. When wanted it was trucked into another building, cut up, trucked back again and sent up two floors on the elevator, run through machines, sent up two floors more, put through a process, sent down two floors, inspected, packed, then again sent up one or two floors for storage, and brought down to the ground floor for shipment. As this was only one of the materials going to make up the finished goods, it was not to be wondered at that often machines stood idle, waiting for the elevator to deliver the stock for them to use up.

As the goods had a ready sale at a good profit, notwithstanding they were made in such a careless manner, a new building was projected and built, and it was evidently the intention to have everything first-class to all outside appearances. A fine electric plant, with motors for the different departments, was put in; nice electric lamps all around; an elegant hot-air system for heating, and a room-to-room telephone equipment so complete that although one could not always get the person he wished to talk with, he would hear half a dozen he did not wish to. These things are all nice to look at and point with pride to; but there are other things. In the machine and repair shop, and it was a good-sized one, the tool-room boy still walked around among the men and into other departments to see if Tom, Dick or the other fellow had not done with the ⅛-inch drill or the 8-32 tap, as someone had been waiting half an hour for it. The stock room was still known as a good place to find out what they had not, and the tool room was the place with no tools. The superintendent still wrote out all the orders for stock personally, while the men stood by and waited for him to do it. Probably they could not write, and nothing must go from the stock room without *his* personal or written order, and men—four at a time by count—waited for him to get back from up-town for stock to work with. Machines still stood idle in the factory because stock could not be gotten around fast enough to keep them going.

Of course, these delays would cause a kick from the office at times, and the man having charge of the works would be sent for and given a "call down;" but some people never seem to catch the idea that what Providence has not given in the way of a person's mental equipment can't be supplied by any number of "call downs," and that heroic treatment is the only cure for a case of factory congestion of this kind. So the case is presented of a place making goods in such demand that the business grows rapidly and still strides backward in methods and management.

FLORIN.

Clearing the Planer Tool.

Editor American Machinist:

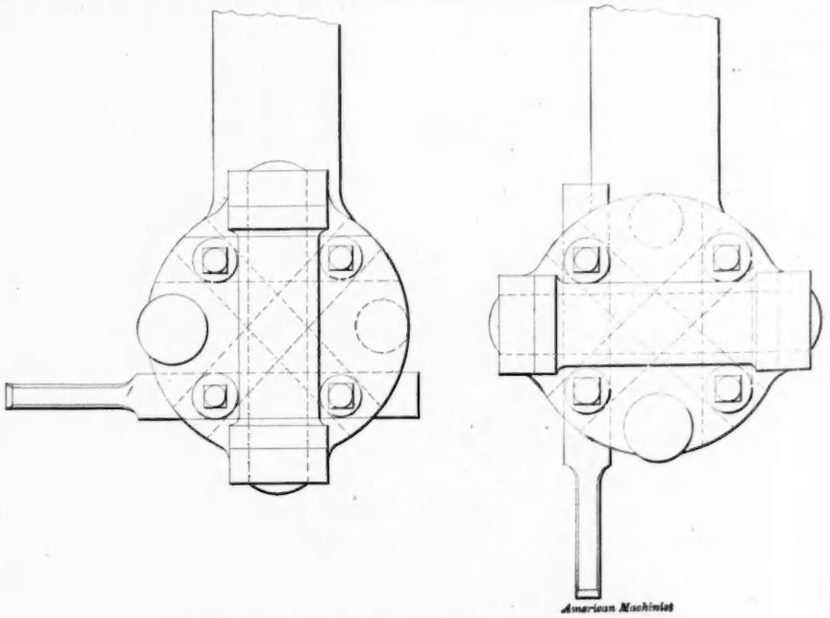
Mr. Fulton's planer tool in your issue of January 25 interested me greatly, and as he invites criticism of the same, I venture to submit the sketch herewith, which is a view of the tool from the back, as seen under the cross rails, this seeming to be the only way to conveniently show it. If Mr. F. could find room for one or two more tool chambers, as I have endeavored to show, at right angles to the pin on which his tool block swings, he could make the initial cuts for his T slots, and do various other jobs involving a parting tool, that his device, as he shows it, would not admit of without using a bent tool. So many tool chambers would honeycomb the tool block in a way to weaken it, besides which it would be an ugly piece to make. Perhaps the design might be changed a little to accommodate this feature, if it is considered desirable.

WALTER GRIFFEN.

Jigs for Drilling Sprocket Wheels.

Editor American Machinist:

The accompanying sketches show a pair of tandem sprockets and the two jigs for drilling the same, so that when the smaller one is mounted upon the larger one, as shown in Fig. 1, they shall revolve true together. The sprockets in question were of the malleable casting variety, and we found the castings for the smaller one (being a mere ring, so to speak) badly warped. The way in which we proceeded to true them was to make a tapered punch, the small end of which would enter freely after the roughness had been filed off, and the large end would stretch the metal slightly as it passed through. We made a ring, or die, to lay the sprockets on in the press, set the punch in, and then came on to it with a blank held in the ram, which would follow the punch through the sprocket and allow the punch to fall through after doing the work. The punch frictioned enough in passing through to carry the face of the wheel down tight against the ring all around, and, as it stretched the metal while in this position, it stayed "put"



THE PARTING TOOL IN THE "FULTON" TOOL HOLDER.

pretty well. We broke but very few sprockets, and invariably these were cold-shut, and it proved to be a good test to put them through, as well as truing them circumferentially and sidewise. The next thing to do was to mill the teeth, which was done upon arbors whose contour corresponded with that of the punch, except,

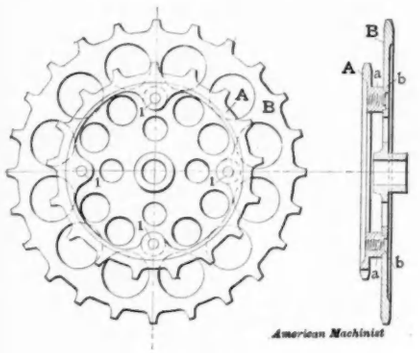


Fig. 1

THE WHEELS TO BE DRILLED.

of course, that it was straight instead of tapering, and with rings to go between the wheels to allow space for the lugs.

The next operation, and the one which I wish to make the principal feature of this article, is the drilling of the screw holes in the bosses *I I I I*, in sprocket *A*, Fig. 2, so that they are located equidistant from each other, and upon a true circle which is concentric with the pitch line of the teeth.

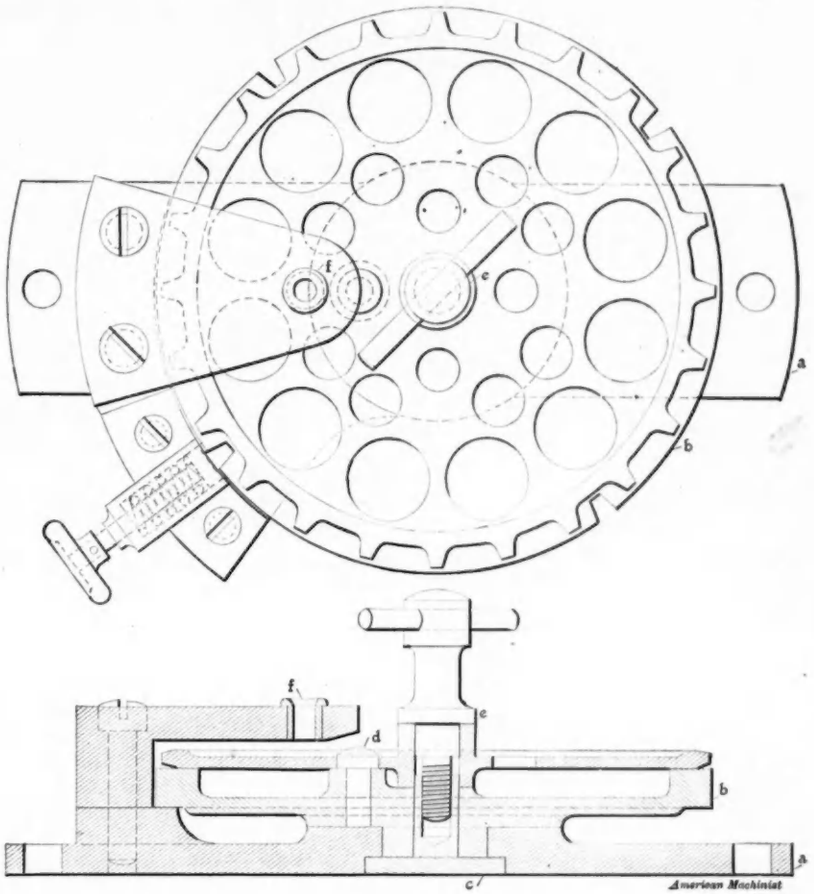


Fig. 3

JIG FOR LARGE SPROCKET.

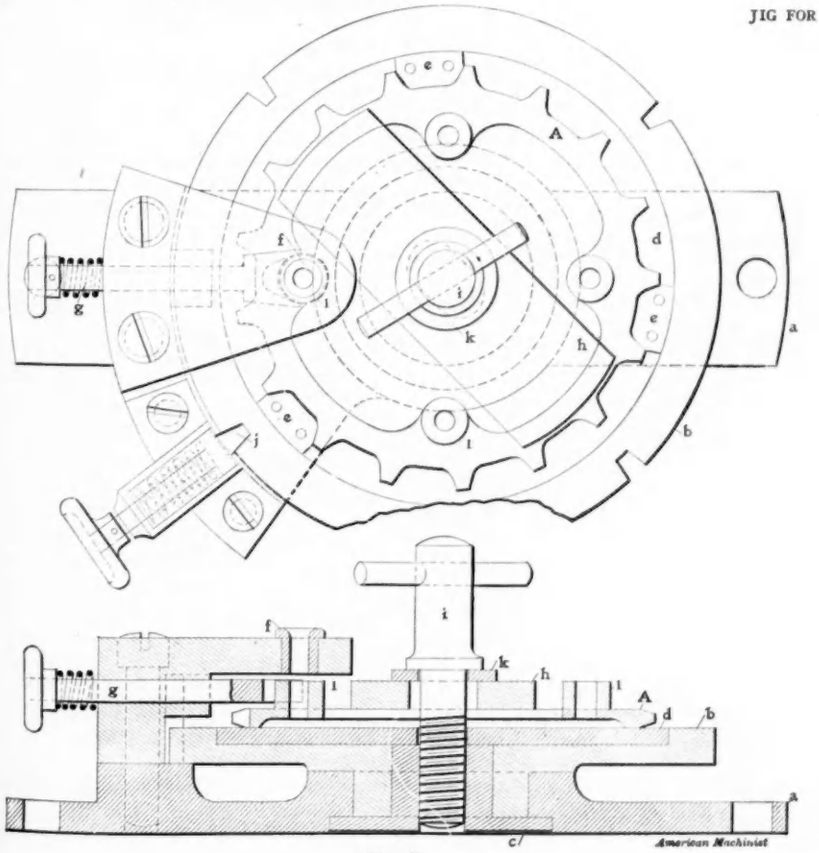


Fig. 2

JIG FOR SMALL SPROCKET.

Referring now to Fig. 2, which shows plan and section of jig with sprocket *A* in position, it will be seen to consist of a base plate *a*, which is bored to receive a projection on plate *b*, which in turn is bored to receive flanged bushing *c*, which was made of machinery steel, and is pressed lightly into *b*, and they are both a working fit in base plate *a*; *b* is counterbored to receive the plain flat disk *d*, which carries three lugs *e e e*, which fit into the tooth spaces, as shown in the sketch.

It is obvious now that the wheel *A* and disk *d* are capable of being revolved together independent of plate *b*, which admits of locating a boss central under drill bush *f* by pressing in on the fork plunger, where it is held with one hand while the crossbar *h* is clamped down tight on the sprocket by means of binding screw *i*, which binds *b*, *c*, *d* and *A* securely together, and they all revolve as a unit when indexed by means of spring pawl *j* into the notches cut in the periphery of plate *b*.

After the first boss is located fairly under the drill bush, the forked plunger *g* is thrown back by a spring, as shown, and held out of the way as the indexing and drilling proceed. *k* is a washer under the shoulder of *i*, which nearly covers the elongated hole in crossbar *h*; this hole is elongated to facilitate putting in and taking out the sprockets, as, by shifting

crossbar endwise it is easy to put in and remove the wheels without removing the crossbar each time. This jig worked very satisfactorily, but, of course, its success was owing in a great measure to the fact that the stretching punch corrected all the irregularities in the castings, which otherwise would have tended to throw the bosses out of position, so that they would not have always offered fair to the drill bush.

After the holes were drilled, the shoulders to fit the counterbore in *B* as shown at *b b* in section, Fig. 1, were cut with a pilot tool with a single cutter in the drill press, after which they were tapped. The jig for drilling sprocket *B*, Fig. 1, is shown in plan and section in Fig. 3. It is of similar construction to that of the one just described, except that it centers the wheel from the reamed crank axle hole, instead of from the milled teeth. It consists of a base plate *a*, which is bored to receive projection on plate *b* which in turn is bored to receive the flanged bushing, the upper end of which serves as a stud, upon which is located the bore of the wheel to be drilled, and is a free fit in base plate. One of the four holes in the web of the wheel nearest the crank axle hole is slipped on the stud *d*, which locates one of the blank spaces fairly under the drill bush, the shouldered stud is screwed down and the drilling proceeds. The indexing is done the same as in the jig for the smaller sprocket. The teeth in this wheel were milled upon the centers after the wheel was brazed on to the axle, as were also the turning and truing.

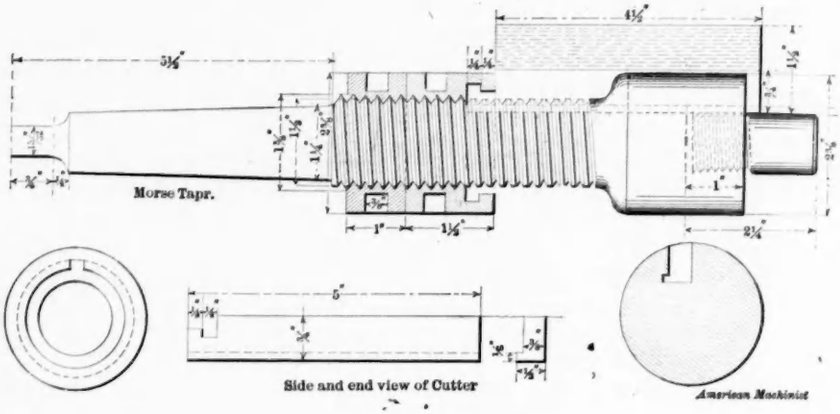
Jackson, Mich. A. G. MILES.

A Universal Counterbore.

Editor American Machinist:

Counterbores are among the most unsatisfactory tools that the machinist of the jobbing shop has to do with. The solid counterbores take considerable time to forge and fit up, and then there never was one that you could grind or sharpen very much or very well. In using a solid counterbore the drill press man may break or burn off a corner, and then after grinding it back enough you have a round corner in next to the tit that can't be remedied without annealing the tool and filing it up again, and it won't even stand that treatment many times.

The counterbore that I show in the sketch may at first strike one as expensive, but it will be well to remember what it replaces. This one will bore from 2½ to 4 inches by sixteenths, and for each size the cutters have 1½ inches or more of length that may be ground away before they are used up. Besides this, the center pin, or tit, is changeable, and may be from 1 inch in diameter up to as large as may be desired, so that this tool is fairly equal to, or, in fact, much better than, a hundred solid counterbores.



A UNIVERSAL COUNTERBORE.

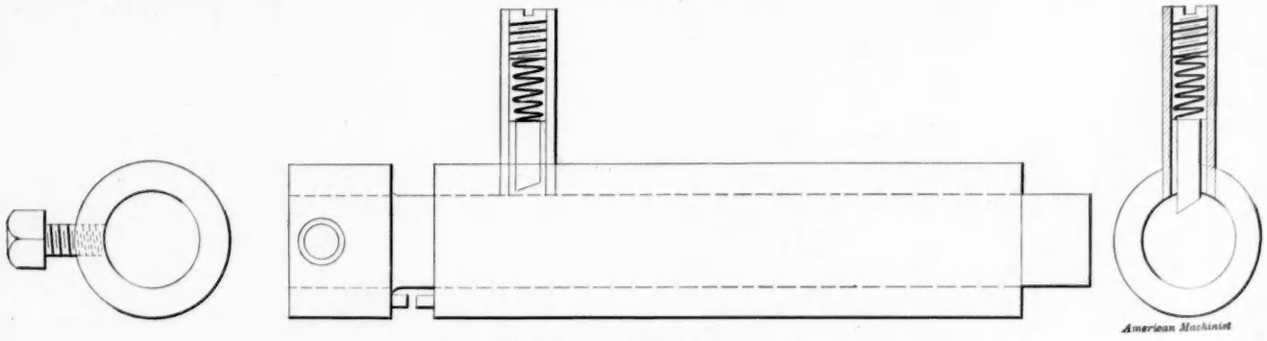
The body of the tool has a standard taper shank to fit the drill spindle; then there is a threaded portion of stem, and below this an enlarged part to guide and to hold the cutters. The lower end is tapped with a 1-inch U. S. standard tap, and to this the central pin of the counterbore is fitted. A set of these pins, of different sizes, may be provided. The body of the tool is of machinery steel, and the pins are of tool steel. The cutters, which are made for each diameter, are inserted in longitudinal grooves, one of which is shown in the section of the body of the tool, with the cutting face radial, and a projection on the inner edge fitting a corresponding side groove, which holds the cutter securely in position. The cutter is held longitudinally and is moved along for adjustment after regrinding by means of a projection which fits into a circular groove in large nut above. The lower face of the nut is notched at one place wide enough to allow the hook of the cutter to slip in. The nut and the check nut above it are round and are moved by pin holes on the sides. In the tool shown, the nuts are tapped with a regular 1⅝-inch machine tap and are then turned on a suitable arbor. The thread on the shank is also cut 1⅝ inches to correspond, but the top is afterwards flatted off to 1½ inches in diameter, still leaving sufficient thread for the service required. The tool is not only used for counterboring, for bolt heads and such work, but it is also an excellent tool for through boring where much stock is to be cut out and where a hole for the center pin is first drilled.

Highlandtown, Md. J. F. MORGAL.

Another Die Holder for the Auto.

Editor American Machinist:

Enclosed please find a sketch of another die holder I consider somewhat better than that of "Automatic," in that it does not weaken the spindle as much and the shell not at all.



ANOTHER DIE HOLDER FOR THE SCREW MACHINE.

I had occasion to make some brass screws, .074 inch diameter, 48 thread, about 1 inch long, which gave trouble, breaking off in the die on the return, until I designed this holder.

It consists of a slot in the spindle holder, into which a plunger is forced by helical spring back of it; the screw back of spring giving the required tension.

"ANOTHER AUTOMATIC."